THE AMERICAN
JOURNAL OF PSYCHOLOGY

Founded by G. STANLEY HALL in 1887.

VOL. XVI. APRIL, 1905. No. 2.

A STUDY IN PRECOCITY AND PREMATURATION.

By LEWIS M. TERMAN, Fellow in Clark University.

TABLE OF CONTENTS.

		PAGE
1.	Definition of the term and scope of the study,	145
2.	The Meaning of Infancy,	148
3.	Education and Prematuration,	153
4.	Over-pressure,	156
5.	Criminal Precocity,	159
6.	Religious Precocity,	164
7.	Precocity and Unbalance,	167
8.	Precocity and Nervousness,	168
9.	Sexual Precocity.	173

I. DEFINITION OF THE TERM AND SCOPE OF THE STUDY.

Perhaps no word has been more persistently used in different senses than *precocity*. The applications have all, of course, something in common; that is, they all pertain in one way or another to an unduly rapid development of some plant or animal organism. But in significance, they are so dissimilar that a few fundamental distinctions must be made.

The general sense is that precocity means development in advance of some assumed norm. But as to what this norm should be, there is no agreement. Many who talk of precocity do not even realize that the assumption of some such norm is necessary. They vacillate between different constructions of the term as now one and now another standpoint is unconsciously assumed. Hence, all sorts of loose talk is indulged in, a variety of misunderstandings comes about, and the confusion reaches such a degree that two authors may verbally contradict each other in trying to say the same thing.

As it is not a purpose of this paper to coin any arbitrary definitions, the several uses may all be presented. Then with

the caution of keeping the distinctions in mind, we could continue to use the term as in general parlance, depending upon the context to give it more definite meaning. The chief of these usages may be illustrated as follows: *First*, when an Englishman writes that the children of the Negro race are precocious, he is evidently setting up his own race as a standard. The Negro child could just as well say of the English child that it is retarded in development. One statement means as much as the other. We simply have a disparity, which may be named from either end. *Second*, the comparison may be confined to the individuals of a single race, and then the mathematical average, or mean, may be taken to judge the precocity of any one. To illustrate, if more white boys reach puberty at 15 years than at any other age, we may reckon all the other boys of that race whose development is more rapid, as precocious. *Third*, the term may be used to designate an early development which is conceived to be aimless, or injurious, without considering whether it is natural to the individual or the race in question. According to this meaning, actual factors of growth and development are left out of consideration, and the individual is judged by some Utopian ideal. For example, any case of falling in love before a certain age, say 15, 16, or what not, is often called precocious, in utter disregard of the extreme probability that nothing could be more in harmony with nature. *Fourth*, we may assume as a norm an all-round development and regard every forward departure from this norm as an example of precocity. In this sense precocity may take as many directions as there are possible lines of physical and mental activity. This application is generally reserved for children like mathematical or musical prodigies. This use ignores the probability that there is not any *a priori*, rational all-roundedness, into which every individual can naturally be fitted; our machine methods and ready made curricula to the contrary, notwithstanding. What would be harmonious for one may be most inharmonious for another. *Fifth*, we may assume as a norm the natural rate of development for any particular individual, without regard either to the remainder of his race or to other races. Examining this standpoint, it seems possible that the natural rate is not the same for any two individuals. It is so with plants. Grains sowed simultaneously germinate successively. Some of the evening primroses used by De Vries in his experiments on mutation were noticed to reach maturity in one-half the time required by others, under conditions as nearly as possible identical. From this point of view, no difference if one individual develops to maturity in one-half of the time required by another, we would not call it precocious so long as the speed of its development is deter-

mined by the momentum of its own vitality. That is, the prodigy of encyclopædic learning at 10 years of age may conceivably be less precocious than the dullard of 20. It may require more pressure to place the latter on a low plane by 20 than to make a scholar of the former by 10. In short, precocity, in this sense, is simply a condition brought about by forced culture. It sets no external standard, but allows each individual to be a law unto himself. It has more to say of the *natural* and *unnatural* than of the *normal* and *abnormal*.

It is not to be decided here which of these view-points is the most fruitful. All of them are legitimate. It must simply be remembered that *precocity* is a blanket term, used in these fundamentally different ways. No difficulty need be met if the distinctions above made are kept in mind. That so much confusion should have arisen must be due to our proneness to accept words rather than meanings. It is so convincing to talk of the "normal" and "abnormal." It appeals to our instinctive dread of being unlike our fellows. To designate a quality or character as "abnormal" is, in the popular mind, to condemn it. Hence children of unusually rapid development have sometimes been called "monsters."

To summarize, we have, *first*, race disparities, and are therefore allowed to speak of race precocity. *Second*, we have natural disparity in the rate of development between individuals of the same race, and can therefore speak of individual precocity. *Third*, we have a totally different sort of thing which could perhaps better be denominated "prematuration," a state that results always from outside interference. In its wide range, it will include such facts as the following: pruning a tree to hasten its fruit, dieting an animal to bring it to early maturity; forcing on a child the activities of the adolescent and upon the adolescent the activities of the adult; the engrafting of mature civilization on to primitive races; of an idealistic religion upon a mind incapable of transcending the concrete; to initiate into the harmonies of Mozart, minds that find more edification in the rattle of tom-toms; in short, every conceivable example of forced culture.

A complete study would embrace all of the aspects mentioned. Natural precocity may help to expose the evil results of a forced precocity, or *vice versa*, and both may be necessary to bring best to light the advantages of a long period of plasticity. Likewise the precocity of the race and of the individual must be interpreted in the light of each other. A biological setting can be gotten by utilizing the hints gained from the literature concerning the forced culture of plants and lower animals. The present study, though originally intended to

cover the entire field, has been gradually narrowed to the subject of prematuration.[1]

A disclaimer should be inserted here. This study does not pretend to be scientific in the strict sense. It applies no exact methods, and possibly may establish no new fact beyond doubt. Confessedly, also, it presents only one side of the argument. It is hoped this will be kept in mind by those who are disposed to criticism. It is content, for the most part, to make suggestions. Indeed, the undeveloped state of child and race psychology would render dogmatism out of the question, for there is almost nothing in genetic psychology that is not germane to the subject of precocity. Genetic psychology would begin with the first cell and make an exposition of every fact in the process of development of the organism in its rise to maturity, through the period of activity, in the decline again to the inanimate. That is, the aim is to arrange the events in an order that is certainly chronological, in the hope that when this is done, the meanings will fall out, so to speak, automatically. If this conception is justifiable, then any scientific treatment of forced precocity must wait for a fuller development of genetic psychology. The nascent stages, to the extent that such exist, will first have to be marked out for every possible line of activity. It is manifestly impossible to say what is premature, until we first know when maturity should come. At present, the establishment of norms has hardly begun. Nevertheless it may still be profitable to bring together some of the facts already at hand in order to see, provisionally, whether they point to any particular educational doctrine.

II. The Meaning of Infancy.

The possibility of precocity presupposes the existence of a period of immaturity and incompleteness. The amœba, which begins its independent life as a perfect individual, is never subject to prematurity. Its environment is so simple that the mere

[1] Readers interested more especially in the biographical study of men of genius are referred to the studies by Sully, Genius and Precocity, Pop. Sci. Monthly, 1886; Carrière, De la Précocité Physique et Intellectuelle, Paris, 1900; and Duché, De la Précocité Intellectuelle, Etude sur le Génie, Paris, 1901. Other works bearing in part upon the subject are: George M. Beard, American Nervousness, N. Y., 1881 (see especially Chap. IV); Dr. Paul Moreau, Des Enfants Prodiges. Annales de Psychiatrie et d'Hypnologie, 1891; Andrew Lang, Genius in Children, North Am. Rev., Jan., 1897; Havelock Ellis, A Study of British Genius, Pop. Sci. Monthly, Vol. 58 (especially Chap. V). Lombroso, Galton, Donaldson, Scripture, Binet and Chamberlain have also touched the subject.

Those interested in the correlation of physical measurements with precocity are referred to the highly contradictory works of W. T. Porter, Dr. Boas, G. M. West, Prof. Gilbert, Dr. Hrdlicka, and others.

protoplasmic reflexes are sufficient to keep it in a living state. But as organisms differentiate and the world becomes filled with them, environment must be met which is more and more complex. And so there comes about the period of infancy whose utility was pointed out by John Fiske, and has been emphasized by Major Powell and a host of others. It is a period of growth and plasticity and has therefore been the making of man. Its length increases more or less proportionately as we ascend the animal scale. From the trematode worm, which exhibits three generations of embryos, one within the other, while the oldest is yet unborn, we ascend gradually to the anthropoid ape, in which infancy is already far developed. Their young are unable to walk, feed themselves, or grasp with precision for two or three months. Generally speaking, the rapidity of development is in inverse ratio to its height. As intelligence develops, maturity becomes more and more delayed, The law seems to hold with close approximation as far as mammals are concerned. The higher the mammal and the more complex its environment, the longer time it requires to get ready to lead an independent life.

The period of infancy is also closely related to the evolution of parental love, which has in this manner become an important element in the struggle for existence. Longer infancy and parental care take the place of excessive fertility and well developed offspring. One sees this in comparing fishes, reptiles, and mammals. Among birds, also, the fewest eggs are to be found in the best made nests. The young thus protected from the struggle for existence have time to develop a mechanism which in time will be able to cope with a complex environment.

It is interesting to compare the young of the quail with the young of the eagle. The former are a numerous progeny. They can run, utter alarms, feign death, and peck grain almost at the very moment of their escape from the shell. Throughout life, these instinctive activities will meet all requirements. Beyond a certain increase in the refinement and accuracy with which these activities are performed, their mental progress will be practically nothing. The eaglet, on the other hand, is long helpless. With his one or two mates he keeps the nest for many weeks and is not mature for 6 to 10 years. As a bird of prey he will have to fight numerous battles in which the degree to which he has acquired skill will be the determining factor. If, for a time, therefore, he is helpless and runs in debt to the world for his care, the mortgage he gives therefor is genuine. Like the Faust document, one can say that it is sealed in blood, for if he fails to make good the debt his life is forfeit.

"In the early history of birds, precocious young were no doubt the rule, and it is interesting to note that they are characteristic of many species in which the organization is relatively low."[1]

A comparison of the guinea pig and the white rat is no less instructive. The white rat at birth is about $\frac{1}{40}$ to $\frac{1}{50}$ of the weight of the adult; its eyes do not function for 16 or 17 days, nor its ears for 13 days; it is naked, ill developed, immature in form and musculature; its nervous system is completely unmedullated; its movements are slight and weak and it can make few co-ordinations for 4 or 5 days. Its activities are purely instinctive up to the 12th day, and it is not psychically mature till 23 to 27 days.[2] On the other hand, the guinea pig[3] at birth is relatively five times as large, as the white rat. That is to say, it is about $\frac{1}{10}$ of the weight of the adult. All its senses are perfect. It is thoroughly covered with fur, and its muscular development is complete except in the hind legs. Its instincts almost fully function at birth and the third day witnesses its complete psychical maturity.

Then comes the sequel, which may be stated in the words of Miss Allen.—"When the guinea pig has forced his way through a labyrinth, he has reached the end of his psychical powers. He cannot pull a latch nor push a bolt; he will not depress an inclined plane, chew a string, nor stamp his foot. . . . The experience of the white rat extends to strange combinations of wires and springs, and all the delightful surprises revealed by secret doors. But when the guinea pig has turned the proper number of corners, his dinner must be waiting for him or he does not get it. The white rat at three days is just learning to crawl, has never seen an object, and remembers nothing. The guinea pig at that age has triumphantly recalled a complex path, at the end of which he sits eating his well-deserved carrot. At 23 days the rat is lifting latches neatly and forming what Hobhouse calls 'practical judgments' as to the value of an inclined plane, in a situation at the centre of which is his food —a desired thing, an end. The guinea pig is still wearing out the floor of the same labyrinth." And, again, "the contrasting features in the two animals are their nervous systems. In the one a mature nervous system is accompanied by psychical maturity; in the other, neural immaturity permits great psychical development."

Coming to human beings, we find first a half dozen years of helplessness; then a series of physical and psychical perturbations

[1] J. R. Davis: The Nat. Hist. of Animals, Vol. VI, p. 473.
[2] John B. Watson: Experimental Study of the Psychical Development of White Rat, Chicago, 1903.
[3] Jessie Allen, J. of Comparative Neurology and Psychology, 1904.

which, as Pres. Hall has pointed out, suggest the landmarks of an old puberty at 6 or 7 years. Recovering from these, the child enjoys 7 or 8 years yet of prepubertal plasticity and growth. Even at puberty he is not mature, but generally in civilized countries enters upon a third period of grace, without which he cannot cope with the complex environment of modern life.

One finds similar facts in comparing the races of men. That is, in general, the rapidity of development is in inverse ratio to its final height and complexity. Scores of anthropologists have added their testimony to this fact. Havelock Ellis says[1] "Among primitive races in all parts af the world, the children at an early age are very precocious in intelligence;" and again, "the lower the race, the more marked is this precocity and its arrest at puberty. It is a fact that must be taken in connection with the peculiarly human character of youthful anthropoid apes and the more degraded morphological character of the adults." The Australian boy at 8 or 9 years of age[2] is able to care for himself and is left to shift alone. Christmann[3] says of the same race that they grow up so quickly as to be practically adults at 11 or 12 years. Taylor[4] says that the Polynesian boy is a half man at an age when our children enter school. Chamberlain[5] says that the Athka Aleut is an independent hunter at 10 and may marry; that the Tahiti boy at 8 is out from under parental control and at 10 or 12 knows as much as his father; and that the Khevsur boy speaks his word in public meetings at 8 or 10. Hrdlicka finds that, "the young of the Navaho, as among other Indians, are more advanced toward maturity, on the average, than whites of corresponding age." The same author finds, in his Anthropological Investigation of 1,000 white and Colored Children of both Sexes, that the average strength in each arm, as measured by the dynamometer, is not only greater for the colored children than for the white, but also greater when calculated in proportion to body weight. Teachers of mixed schools in the Northern States are continually surprised at the rapid school progress made by the negro child for the first few years, in many cases even outdoing his white competitors. But before long the tide turns and the negro child relapses into a state of chronic stupidity, while the white child pushes on to heights the former will never see.

With the lengthening of the period of infancy there is a concomitant increase of brain surface.[6] These elements are each

[1] Man and Woman. London, 1894, p. 177.
[2] Ploss: Das Kind, p. 334.
[3] Quoted by Ploss, *loc. cit.*
[4] Quoted by Ploss, p. 336.
[5] *Loc. cit.*, p. 53.
[6] *Vide*, John Fiske: Destiny of Man, Chap. on Infancy.

favorable to the other. The prolonged plasticity means simply prolonged teachableness; and this means that as training counts for more, heredity counts for less. The chick inherits next to everything, man little, in the way of definite reactions. Or to use the figure of Lloyd Morgan, the inheritance of the chick is parcelled out into definite sums, each of which, according to nature's will and testament, must be applied in a definite way: while that of man is a bank account, available for any kind of momentary emergency. For this advantage, the helplessness of a long continued infancy is the price. All systems of education may be viewed only as means devised to help us get the full value of our bargain; and if man would live for the future rather than for the present, his chief concern must be to see that the younger generation comes to its full inheritance,—in other words, that it reaches the fullest possible maturity.

This interpretation of infancy, however, is not even comparatively new. Comenius says: "In some children the natural capacities would fly before the sixth, fifth, or even the fourth year; and yet it will be beneficial rather to restrain than permit this. By acting otherwise, the parents who, on rare occasions, have a Doctor of Philosophy before the time, will often have a Bachelor of Arts and oftener a Fool. The vine, at first luxuriating too much and sending forth clusters thickly, will no doubt, grow to a great height, but its root will be deprived of vigor and nothing will be durable." Froebel likewise says: "How different could this be in every respect . . . . If parents were to consider the fact that the vigorous and complete development and cultivation of each succesive stage depends on the vigorous, complete, and characteristic development of each and all preceding stages of life! The boy has not become a boy, nor has the youth become a youth, by reaching a certain age, but only by having lived through childhood, and further on, through boyhood, true to the requirements of his mind, his feelings, and his body. . . . To see and respect in the child and the boy the germ and promise of the coming youth and man is very different from asking the child or boy to show himself a youth or man; to feel, to think, and to conduct himself as a youth or a man."

Rousseau's entire educational teaching centres in this one thought. For example: "We pity the state of infancy; we do not perceive that the race would have perished if it had not begun by being a child." "The most important rule is to lose time, not to gain it." "Every age and every station in life has a perfection, a maturity, all its own. We often hear of a full grown man; in contemplating a full grown child we shall find more novelty and perhaps no less pleasure." "A virtue prematurely taught sows the seed of a future vice."

But the principle has not yet worked the transformation in our attitude toward child life that an unreserved surrender to it would necessarily imply. From an examination of the educational practices of all the enlightened countries one finds much to support the belief that, like Descartes, many of our educators lamentably deplore the long years of childhood as a desert waste, to be crossed for the sake of what lies beyond, but in itself barren and worthless.

III. Education and Prematuration.

The schools of the leading civilized countries make for prematurity. To make such a charge, however, would seem to contradict the very essence of a school and its *raison d'etre.* For the school is supposed to have been organized for the one purpose of fitting for life by lengthening the apprenticeship to life's activities. Whereas the savage child is initiated into the rights and duties of citizenship at the early age of puberty and from that period stands on equal terms with the men and women of his race, civilized man denies his child this privilege for years to come. This means that we now regard life as something too momentous to plunge into precipitately, and that we consider it highly necessary to pause for a few brief years in order to get the bearings and to gather strength for the battle. It would seem, therefore, the peculiar purpose of the school to stand for the prolongation of human infancy.

On the contrary, from a look into many of our schools, one is forced to the view that we are guided by the exactly opposite principle; namely, that childhood is a necessary evil, that adulthood is the only perfect state, and that the chief business of the school is to make boys and girls into men and women by the shortest method possible. After looking about us to see what it would be well for the adult to know, how he should reason, what emotions he ought to feel and the actions that ought to follow from them, we proceed at once to drill the child in these ways of thinking, feeling, and doing. Forgetting or ignoring that the definition of education is not static, but changes constantly with the development of the child, we end by inverting the subject matter from its true order of presentation and employ methods unsuited to the stage of the pupil's development.

The evil effects of such training are set forth, in so far as they concern Nature Study, by Dr. Hodge.[1] There is room for a similar study in every branch of school work. The criticisms of Dr. Hodge, though aimed altogether against current methods of Nature Study, apply with almost equal force

[1] Foundations of Nature Study, *Ped. Sem.*, Vols. VI and VII.

everywhere. His conclusions are, in substance, as follows: "To make classifications an important part in elementary science is to put the cart before the horse." "Things must precede names." Book learning is the "knowledge that puffeth up." College professors continually prefer students who have not dabbled in the sciences. The one who comes with his book knowledge is "the *bête noire* of the college professor." His condition is that of "fatty degeneration of the soul." Such work breeds conceit, and "it is easier to make a competent investigator out of a dull than out of a conceited man." "Covering all the universe so beautifully" the ordinary Nature Study course puts the boy in the condition of "a cucumber that has turned yellow before the blossom opens." It "sickles the child o'er with the pale cast of adult 'proper conclusions,'" marks the "closing in upon him of the shades of the prison house," and brings it about that "very few ever grow into the fullest realization of the possibilities of their infancy."

Burk[1] has shown the absurdity of the current methods of teaching drawing to children. He finds, without exception, that all text books of drawing put out in the United States previous to 1902, were based on the logical order, ignoring thereby every law of child development. Overlooking the fact that motor imagery plays a greater part in the child's mentality than does visual, the child is put to artistic work the performance of which presupposes the segregation of visual control and its complete influence over the movements, when in point of fact such control is impossible. Accuracy and precision are required when they have no rightful place. Problems of perspective are given before the child can appreciate what perspective is. The school curriculum attempts to answer the question *how*, long before the child asks or cares to know. His interests as regards subject matter for drawing are also whipped into submission. While interested in such matters as the human figure, he is put to constructing geometrical designs, which forces his interests by several years at least.

Everywhere we turn the same situation confronts us. We refuse to be guided by the healthy instincts of the child. In the words of President Hall, "We push the rational to the detriment of the intuitional." Instead of trying to find out what is indigenous to the human soul and how we could best build upon this, we rather consider it a blank page upon which to inscribe adult "proper conclusions." Forgetting that the child's thinking can only be spontaneous, flitting, and illogical, we try to force it into the paths of formality and logical order.

[1] The Genetic Versus the Logical Order in Drawing, *Ped. Sem.*, 1902.

"Youth and childhood are subordinated as means to maturity. We teach results without the methods by which the results were obtained. We develop the sense of possession without the strain of activity. We give extensive knowledge at the cost of intensive. And nothing is better suited to create the blasé type. As all beginnings are easy, and difficulties increase geometrically, the will can only be trained by sustained work in a few lines." [1]

It is widely attested that the precocious culture of rationality weakens the tendency to activity. Numerous studies in experimental psychology point to the conclusion that the effect of mental work is psycho-motor inhibition, while on the other hand the effect of physical work is psycho-motor excitation.[2]

Janet finds that the psychasthenics are as a class strikingly intellectual. They are ready of speech and are not deficient in understanding. But they will not act. Their conduct when about to begin anything is best described by the homely term "finnicky." They demand a thousand impossible conditions to be met before they will move. Corresponding with this, they are somewhat lacking in their sense of the real, a state that tends to result from an over-rational training.

Such children are likely to become nervous, excitable and to fear effort. With unlimited desires they yet withdraw from the struggle through intellectual fatigue, become apathetic and pessimistic; a suggestion to be taken in connection with the alarming increase of child suicide and juvenile criminality in all civilized countries.

It is well known that manhood and womanhood normally bring a certain amount of disillusionment. The real world as the adult finds it never measures up to the fairy world which the child has looked forward to. The confident ambitions of youth are not realized in their fullness. Most men and women, however, accept the situation philosophically when it finally presents itself. They find a modest station in life and make the best of the opportunities that come. But if, through the prematuring effects of a wrong education, the disillusionment comes too early, before the will has developed and while the passions are still explosive, we have the prime conditions for making the youthful suicide or criminal on one hand, or the cynic and pessimist on the other. It is a common remark that one finds among German university students an air of pessimism. The usual explanation is that it involves nothing more than a fashion which comes largely from the popular influence of Germany's great pessimistic philosophers. There is the

[1] See Hall: Moral Ed. and Will Training, *Ped. Sem.*, Vol. II, p. 87.
[2] *Vide* Karl Miesener: Ueber psychische Wirkungen körperlicher u. geistiger Arbeit. Psycholog. Arbeiten, Vol. IV, p. 375.

possibility, however, that all this is symptomatic of a more serious ailment. There can be no doubt that the German boy is hurried to an early maturity. At 18 or 19 years he stands before the world almost the equal in scholarship of our college graduate of 22. On the other hand he has seen less of the world and has been kept continually under the close surveillance of class-room drill. At this time he is ushered into the "Lernfreiheit" of the university, which demands a degree of judgment and self-control which his previous education has not fostered. His *morale* will not support with sanity and balance the new world-views which he has so suddenly come upon. There naturally results a certain looseness of character generally characterized by an attitude of cynicism and pessimism. No pessimism is agreeable. That, however, which grows up as a settled philosophical conviction can be understood and even sympathized with. But the precocious pessimist is an anomaly in the world, and in some cases, at least, he is a product of educational prematuration.

IV. Over-pressure.

Closely connected with this forced culture are the omnipresent symptoms of over-pressure, a condition better defined by the French word "le surmenage." The term is taken from its application to beasts of burden, and expresses the full situation better than any English equivalent.

The charge of over-pressure is an old one. Plutarch even in his day complains that children are over-burdened at school and lose all desire for healthful sports. Mantaigne complains that children are kept 14 or 15 hours in the "hell of work." Hufeland complains of its causing a precocious nervous development leading to weakness. For the last century the question is one of the most important in German education. The sciences are developing and demanding more and more space in the curriculum. Meanwhile the classics refuse to be displaced. It is the old struggle between Humanism and Realism, and the child is given over in sacrifice in order that both may be placated. The situation is most critical in Germany, but is growing in importance in the United States.

The evil effects of forcing are not noticed so much in children of unusually strong nervous endowment. It is the children who already have a heavy burden of hereditary neuroses that suffer most. Bodily functions that are already weak are dangerously undermined by the high pressure of the average school. The resulting nervousness shows itself in innumerable ways. Krafft-Ebing blames the long study hours for a large part of the mental strain, paleness, dull eyes, myopia, dizziness, and headache of school-children. He

thinks the dull boy is injured no less than the bright one, for if he belongs to the higher classes he is pushed, crowded, and tutored privately till he finally becomes either a nervous wreck or a helpless graduate.

We have already seen that chronic fatigue has been cited as a predisposing factor in juvenile criminality. Several of the alienists, notably Dr. Christian, thinks it is an important element in causing dementia præcox. Out of 100 cases studied by Christian, 22 had given unusual promise of mental ability. Morel also states that most of his patients were unusually bright in their school work. Over-pressure at least seems exactly suited to bring out slight hereditary defects of the nervous system. W. S. Monroe, from an extensive investigation of chorea among school children comes to the conclusion that it is very often the result of premature promotion in the grades, over-work, and worry about the school tasks. Dr. Weir Mitchell shows that outbreaks of chorea are more common and more severe among school children during periods of formal examinations than at any other time.

Strümpell says: "An education which neglects the strengthening of the will, which excites to an extraordinary degree the imagination of the child, which over-burdens the mind and brings about a premature psychical development, is too often the cause of the weak and excitable conditions of the nervous system which give rise to hysteria."

Szejko[1] shows that overpressure in the schools plays a part in many cases of acquired neurasthenia. He thinks the danger of neurasthenia is especially great with precocious children. They are serious beyond their years, interested in everything that feeds the intelligence. They reason, reflect, and observe like adults. They are all the time trying to solve problems that present themselves to their active brains. This intellectual and moral tension is strongly accentuated at puberty and the subject may pass over into a state of neurasthenia. M. Bouveret thinks it is one of the chief signs of hereditary neurasthenia for a child to show precocious mental development. This recalls the saying of Scholz to the effect that those pupils at the head of their classes are not the promising ones, but would better be denominated "Angstkinder." Ludwig Cernej[2] thinks that precocity is usually pathological and that early instruction is the worst thing that can be done for it, for, as he says, it is the precocious child who incurs the greatest danger of over-pressure. Ziller says that excitability of the nervous

[1] Influence of Education on Development of Neurasthenia, Lyon, 1902.

[2] Frühreife u. Entartung, Kinderfehler, 1901, p. 129.

system, need of artificial stimulation, lack of pleasure in life and activity are often connected with premature work and growth in our public schools. Fuchs thinks that acquired states of subnormal mentality are often due to school over-pressure. Micolaoj[1] regrets that while the child should be resplendent with life it is only a small fatigued adult. "*Son esprit est lassé, son cœur est desséché, son âme rétrécie, . . . mais il est breveté.*"

These suggestions give a slight basis to the old saying that "Kluge Kinder sterben früh," or "Whom the god's love die young." That is, nervousness and precocity are frequent companions, and the over-stimulation of the nervous constitution will, in many cases, cause it to succumb to disease. Escaping this fate, the precocious child may fall into neurasthenia or chronic dullness. Hebel tells of a 9 year old boy who was able as a small child to explain the principle of the steam engine, who was made a "Paradepferd" on account of it, but who in later life learned little else. Cramer tells of a 28 year old dullard who as a child had asked: "Which do you prefer, Schiller's *Räuber*, or Goethe's *Götz von Berlichingen?*"

It will be objected to these, that individual examples prove nothing, and that the very fact of the precocious mental development of a majority of geniuses makes it absurd to take precocity in the bad sense and then cry out against the evils of precocity in general. It is true that we must distinguish the precocity of real genius from the spurious precocity that goes with nervous unbalance. The former kind is most likely prophetic of true greatness, while the latter is only a will-o-the-wisp. The former can digest a rich educational diet and be the stronger for it. The latter stands rather in need of medical care than educational. Their nervous hyperæsthesia and instability is sadly aggravated by over-pressure until the case ends in chorea, hysteria, neurasthenia, dementia præcox, or in some cases criminality or suicide. Their condition reminds one of a straw fire, giving great promise, but going out with greater rapidity when blown into. Between these two sorts of precocity the teacher and parent must be careful to discriminate. Brightness in itself is not an unfavorable symptom in a child, but all morbid manifestations accompanying it should be viewed with suspicion. It is in this kind of subjects that the evil effects of over-pressure are most often seen.

The number of such cases is no doubt far greater than most teachers realize. We always tend quickly to lose sight of those who fall by the way. As teachers, we remember rather the few who remain with us and complete the courses. If we are satis-

[1] Les Enfants mal élevés, p. 422-425.

fied with these, we take little thought for those whom our methods have destroyed.

It is the erroneous view of the purpose of childhood and youth that lies at the basis of the greatest number of educational sins. All agree that this extended period must be utilized in some sort of preparation for life. The difference comes when we consider whether it is best to leave the child to grow up by natural means and in the paths of natural interests, or on the other hand to cram him lustily with the knowledge that adults are supposed to stand in need of. The latter view has had undue influence in shaping our educational policies. We need to bathe ourselves once more in the wisdom of Rousseau's *Emile*. As President Hall has said, "Every encroachment upon the liberties of the child has a certain presumption against it, and the only justification lies in the necessity." Some concession must, of course, be made. The environment is ever increasing in complexity and it is necessary that the child cultivate some sort of rational *rapport* with it. Every concession, however, should be made with reluctance. The words of Sikorsky might well be taken as the teacher's motto: "Life does not demand of youth any deeds, but leaves it to develop, to ripen, to extend its horizon, to organize its soul, and to build life-programmes. Youth is entirely in the future, it lives upon hope."

V. Criminal Precocity.

Notwithstanding the extreme difficulty of gathering reliable statistics of juvenile criminality and the far greater difficulty of interpreting them, the criminologists nevertheless assure us that the precocity of crime is on the increase in most parts of Europe and America. The array of evidence is endless and complicated and can be dealt with properly only by one trained in criminal statistics. The increase in criminal precocity, however, seems to be true for Italy, France, Russia, Germany, England, and the United States. It holds for the ordinary crimes, for prostitution and for suicide. It appears also more largely true of the city than of the country. Worst of all, the tendency seems to be in no wise lessened by the diffusion of school instruction. We may provisionally accept these momentous conclusions as warranted. What is their significance?

At least three suppositions are possible to account for it. *First*, increase in criminal precocity may mean that the criminal born reach naturally an earlier maturity than formerly. *Second*, if we grant with Ferri that criminal precocity is almost an invariable mark of the criminal born, then we now have more born criminals than ever before. Or, *third*, that modern

environment is becoming more and more suited to draw out and exaggerate the criminal propensities which, as Lombroso and others have emphasized, are normal to childhood and youth; or rather, we may say, less suited to keep these in abeyance. I know of no serious evidence in support of either of the first two propositions. For the third there is much evidence, though in the nature of the case it cannot be marshalled so as to constitute scientific proof.

Joly emphasizes the following points: That crime is more precocious in cities and, in general, varies with the density of the population; that the desertion of rural homes for life in congested cities, especially by young men and women, exposes them to the very temptations which at that age they are least able to withstand, and is likely to result in a break up of former moral habits; that the modern system of gratuitous public education displaces the apprenticeship system of industrial training and gives no valid substitute; that heredity counts for little, that abandonment and lack of wholesome family life are important causes in the city; and finally, that by turning the child's attention from nature to worldly affairs our civilization hastens maturity; that it gives a precocity in prattling, smartness, and vice but not in real intellect or strength of will.

Proal also lays stress on the effects of city life, where, as he says, "virtue retires and vice is flagrant." In addition, he believes that theatres, nude art, and bad literature play an important part in the increase of criminal precocity. He warns against encouraging the child to cultivate interests in adult affairs before the development of his will permits him properly to pursue these interests.

Corré dwells at length on the extent of juvenile criminality and the causes that favor it. He speaks mostly for France, but the conditions he emphasizes are general. He thinks the increase is even greater than the criminal statistics indicate. He gives it as his opinion that if we could be suddenly enlightened by a complete and true picture of the extent to which the young are imbued with anti-social ideas, we would stand aghast. He states that certain districts of Paris are continually terrorized by criminals who are mere boys. These have their mistresses who are partners in their crimes. They fight their duels, in which other boys act as seconds. Corré finds crime greatest at the age of greatest physiological and social activity. Anything, therefore, that hastens the latter will hasten the former. Girls, for example, are less criminal than boys, but the criminality they do possess shows itself about two years earlier, in harmony with their earlier physiological and social maturity. We shall see later how city life and other cir-

cumstances seem to hasten puberty. The argument is that these same influences are making criminality more precocious.

Corré shows that low forms of literature have a circulation among the young of France that is appalling. Many of these are filled with revolting pictorial illustrations. What the younger boys cannot understand the older ones explain. A large proportion of the suicides, murders and rapes committed are carried out in a spectacular manner plainly suggested by their reading. Corré pleads for the suppression of such literature. It may here be mentioned that 26 periodicals legally circulating in the United States are excluded from Canada.[1]

But, more than anywhere else, Corré believes, that the worst trouble lies in the kind of education now given the young. His thesis is that ignorance *per se*, does not make for criminality, nor instruction for morality. He shows how juvenile criminality has enormously increased during the very period of most universal gratuitous education. He does not blame education in itself, but believes that we have *instructed* our children rather than *educated* them. Intellectual education is at best a vaccination against crime that often fails to take; while proper volitional and emotional education acts as a system of hygiene, changing the entire being to the marrow. The very regions of France that have the most schools and the best attendance are also the ones that show most alarming increase of juvenile criminality. Instruction, so far from being a barrier against crime, may even appear as one of its factors. Quetelet long ago declared that instruction which consists only in learning to read and write becomes for the most part only a new instrument for crime.

Corré arraigns French civilization as encouraging vanity of every sort. Girls are taught airs and elegancies. They do not prize virtue, and marry men who revel in adultery. Boys are, by example if not otherwise, taught dissimulation and selfish calculation. Success is vaunted before the young with no regard to how it has been obtained. Work is looked upon as a means of getting money and of putting one's self in position to make others envious. On every side less attention goes to content than to covering.

In no field of crime is the growing precocity more marked than in suicide. It would seem to be one of the strongest indictments against the prematuring effects of modern education as carried on by the leading nations, that what should be a period of veritable intoxication from the overflow of joyous animal spirits, is frequently burdened with sorrows so keenly felt that relief is purchased by suicide. In France, according

[1] Hall: Adolescence.

to Friederich, the suicides of minors doubled from 1874 to 1878, and from 1881 to 1895 the increase was 50%. In Saxony, from 1870 to 1875, 24 boys and 2 girls suicided, while in the five succeeding years there were 50 boys and 10 girls. In Austria, while suicides for men were increasing 20% and for women 11%, the increase for adolescents between 15 and 20 years was 40%, and for children under 15 the increase was 60%. Manheimer finds that it is worse in large cities, that it increases with the spread of intellectual culture and with the growing organization of public schools. He therefore imputes the result largely to overwork and to the fact that education is almost exclusively intellectual. Friederich holds that it is in part due to the premature awakening of the sexual instincts.

It must be admitted that there is evidently no way to find out all the factors in juvenile criminality and suicide nor to tabulate just how much each factor contributes. It does seem unnecessary, however, to seek for causes beyond environmental influence to account for the *increase* in precocity. Heredity will account for it only on the supposition that the civilized races are becoming neuropathic and generally degenerate. Looking for recent notable changes in environment a few chief facts arrest the attention. First, the great industrial evolution of the last century, so much emphasized by the socialists, has worked far-reaching results. Population has become more and more congested in large cities, where imitation has greatest scope and where is more likely to be seen that part of man's nature least worthy of imitation. The farm with its scores of rudimentary and primitive industries affording unexcelled advantages for the encouragement of mental balance, is being rapidly deserted for the office, shop, and factory. Home life becomes less wholesome, and temptations are vastly increased. Instead of living to work, the person daily goes mechanically through eight hours of monotonous labor in order to receive on Saturday an envelope with a stated number of dollars. There can be no doubt that the lack of interest engendered by such a system makes for a duality between one's life and one's work that cannot be bridged, and that may go far toward undermining whatever moral qualities are not most firmly established.

Simultaneously with these industrial changes have occurred equally important transformations in the educational world. Instruction has become universal and gratuitous. We seem to think, as Sir Walter Raleigh said of the ax, that it cures all the ills of life. Heroic effort is made to boost every child just as near to the top of the intellectual ladder as possible and to do so in the shortest possible time. Meanwhile, the child's own instincts and emotions, on which alone all volition is based, are

allowed to wither away. No adjustment of clock wheels, however complicated and delicate, can avail if the mainspring is wrongly attached or altogether missing. We forget that activity is not based upon intellect. The latter, as President Hall emphasizes, is an upstart, a parvenu, without much influence even in our human mentality. Instinct preceded it by ages. In man its over-emphasis is a recent phenomenon. Primitive man is swayed by passions that are as foreign to us as the strains of Beethoven to the deaf. Languages still show the marks of their emotional origin but are now becoming prostituted to the requirements of exact science. We analyze life rather than live it.

In our present environment this emphasis of intellect may be to an extent unavoidable. But granting that, we can at least avoid prematurely forcing the young into the same condition. School work is begun too early and does not educate the child as a whole. If the boy only amasses the prescribed amount of knowledge, and if the girl only glosses herself over with a little music, art and literature, little heed is paid to the rest.

The foundations of character must be laid broad and deep in those qualities that are indigenous. The intellect should cap the pyramid instead of rendering it top-heavy. To build up the intellect at the expense of the rest of mentality robs it of every element that ennobles it. It becomes mechanical and has no life blood behind it. It does not suffice to make the child see, and know, and calculate good and evil passively. In that case he is likely to stand where ought to be the hot battle line between good and evil, with no emotions ruffled. Good and evil will be objective things but no longer subjective. There is no better example of forced culture than the teaching of the standard and barren problems of formalistic ethics in our normal schools and colleges. To have a pet theory of the nature of abstract goodness does not enable us to evaluate concrete activities, which after all are the only kind we ever have to choose between. Better than empty work of that kind would be such subject matter as concrete problems in sociology. This or something similar ought to form a long apprenticeship to the study of ethics. To teach form before content and to the exclusion of content, breeds conceit, laziness and the related vices.

The above are only a few illustrations of many plausible indictments that could be made. Statistics of juvenile criminality show that we have not made boys and girls better by instructing them. We were foolish ever to have hoped for such a result. If we would control action we must go to the source of action. It is probable that by over instruction we have directly contributed to the result we would avoid.

Moreover, educated crime has a taint that primitive crime does not have. The latter has a certain naïveté that makes it less repulsive. The crimes of the savage are more bungling and easily detected. He cannot live with respect among his fellows. We have made the intellect able to refine the methods of crime to such a degree that already it has become impossible to detect half the criminal acts that are performed. It is not claimed that the remedy lies in a deliberate return to ignorance; yet not more will it be found in mere instruction.

VI. Religious Precocity.

It is strange that so little attention has been given to finding out what are the actual religious needs of children. The average person of most countries expends a large portion of his energies upon religious institutions. Sunday schools are conducted for children at considerable cost. In various shapes and forms this activity dates back as far as history itself.

It would seem, therefore, after so much trying on, that we ought now to have succeeded in fitting with infinite nicety religious and moral instruction to the native capacities of the child. Nothing could be farther from the truth. The ocean of child-study material put forth in the last twenty years has hardly more than touched the subject. Several well trained men are needed to devote themselves to the research. They should be anthropologists, and physiologists as well as psychologists. They must establish norms of religious growth. They must search out the religious interests that are spontaneous. Only by the greatest care will it be possible to separate these from such as are grafted by religious environment. The environmental differences to be considered are not only those within a given religion, but those among all religions. At present, no one, except in the most general terms, can say when and how religious instruction ought to begin.

Anthropology presents both extremes. Some savage tribes give little or no religious education to the children. But leaving out of account other religions than our own, the practice most common is to begin in the earliest years, before it is even hoped that the child understands what is told him. He is told about God and angels before he cares to hear of them or can comprehend even the rudiments of the information imparted. Overheard whisperings about death implant in him a terrible fear of his own possible death and of his relatives'. He could be kept in ignorance at least a few years longer. Worst of all, he is likely to be informed that a hell of fire is waiting to consume those who have led sinful lives. He may thereby suffer the most intense mental anguish for years when he ought not even to know that such a thing as sin exists, or if it does, that

it involves anything more serious than the temporary loss of a mother's love and the refusal of her good night embrace. He is asked to surrender himself to the story of the cross, before the altruistic feelings have been born which alone will enable him to comprehend the appeal and to respond to it.

On the other hand, one is at a loss if asked to lay down concrete dates at which particular religious training ought to begin. In the present state of affairs the criticism must be largely negative. There is probably anyway more danger of giving too much than not enough. For several years the child is by nature non-religious. Unless by birth a moral degenerate he asks no further incentive to good behaviour than the wishes of his parents. The highest interest of his life, if he has been well trained, is to stand well in their sight. He asks no more authoritative call to duty than their command, and needs no keener rebuke than their disapprobation. It is likely that for eight or nine years the child need not, and therefore ought not, to know anything about right and wrong. His one habit and the very gospel of his life should be obedience. To reason overmuch with him perverts him. As Rousseau says, there is nothing more stupid than a child who has been reasoned with.

We must explore the child's natural interests and take our cue from them. Until the awakening of altruism it will be useless to try to force upon his comprehension a religion whose keynote is love and sympathy. The child is, and ought to be, an egoist. He can be nothing else until he has roughly but rationally evaluated himself as set over against other individuals. But healthy children are not interested in the subjective. They live in an objective world. They have not learned to oppose the world and self. They are not capable of the self examination and self criticism which is necessary to the consciousness of sin. A heightened self-consciousness in childhood is morbid. It is very likely to accompany nervous instability and is common among children who have been prematurely trained religiously. The morbidity may show itself in a thousand ways. Exaggerated scruples, puerile fears, insomnia, onanism and abnormal erotic desires are frequent accompaniments. There is often an unnatural and insatiable curiosity about matters pertaining to God, heaven, hell, angels, death, spirits, etc.

Nagaty[1] has shown how the morbidity may reach such a stage, even in children, as properly to be termed religious insanity, of which he finds many cases before adolescence. Even adolescent cases show often a morbidity reaching back into early childhood. Nagaty describes two cases at length. One

[1] La Folie Religieuse, Paris, 1886.

of these, a girl, had been subject to religious sentiments from earliest childhood. At 5½ years she consecrated herself to Jesus. At 6 she was disgusted with worldly affairs. Before long erotic ideas and religious hallucinations began. Another case, also a girl, had been accustomed as a child to practice maceration and to spend whole nights in prayer. Nagaty finds most of his subjects in homes that are distinguished by an excessively religious atmosphere. It is also noteworthy that he thinks religious morbidity more common among Protestant than among Catholic children. This, if true, must be viewed in connection with the exaggerated emphasis placed by Protestant denominations upon conversion. It is arbitrarily made a dividing line between the "saved" and the "unsaved." Certain unessential elements are unduly dwelt upon. If these are not experienced the conversion is not regarded as genuine. The child is precociously led into a search for the experiences of conversion as the only assurance of escape from a punishment, which perhaps more than any other that could be threatened, is suited to terrify his imagination.

The holding of children's revivals has even become a specialty to which some ministers devote most of their time. The most noted of modern children's revivalists, no doubt, is Edward Payson Hammond. His books are a full account of his work and methods.[1]

For 31 years or longer he worked actively in the United States, England, and Scotland. He preached in some of the most noted pulpits. His meetings were invariably attended by large crowds, a considerable portion of whom were children. He preaches the doctrine of innate depravity in its totality. He dwells on the so-called change of heart, feeling of salvation, sense of sin, etc. He enumerates five essential and stereotyped marks of conversion. They are, love for God's people, love of the Bible, desire for prayer, love of the Saviour, and a desire to see others converted. Every would-be convert is compelled to stand the fire of cross-questioning on every point in this list. Rev. Hammond piously assures us that thousands of children from four to six years of age have given him satisfactory evidence of all these. He sets no age limit whatever, mentioning a few converts between two and three years old. He thinks a majority may profitably be converted by the age of eight or ten. The extent to which such work is carried on, and the sanction bestowed on it from high quarters, make it impossible to consider the matter lightly, or to regard the danger of religious precocity as a spurious one.

[1] The Conversion of Children, 1877, pp. 174, and Early Conversions, 1901, pp. 224.

Moreover, by insistence upon dogma, the period of adolescent doubt is brought on prematurely. The child readily accepts mythologies of whatever sort. He has not yet learned and does not care to separate the real from the unreal. If not interfered with he will naturally make the separation in due time. If the transition is allowed to come gradually and without violence, he will not suffer from it. It is not completed until a stage of development is reached assuring a calm balance of reason. Under the present conditions the natural sequence of events is too often not allowed. Because of the church's insistence on doctrinal points, the child is compelled to listen to arguments for and against their validity. His attention, therefore, is precociously called to the rational phase of religion. Whether he decides for or against the traditional orthodoxy, it is almost certain that his opinion will lack breadth of view. He will be led either to unreasoning dogmatism or to atheism and the cynical attitude toward all religions. The latter fault is more likely to be corrected than the former. Thus, by insistence upon the letter rather than the spirit, the break from the myth-lore of childhood, which ought to be a gradual and natural process of disillusionment, is likely to be made into a cataclysm from the shock of which the individual will not soon recover.

VII. Precocity and Unbalance.

All writers on the precocity of genius note the extreme frequency with which it appears in particular lines only, while in other respects there is no unusual promise. This must not be taken as a necessary corollary to the fact that adult geniuses are universally more or less one-sided. The latter is unavoidable. It is due rather to mechanical pressure from without, such as the shortness of human life and the finiteness of human comprehension. It is admitted also that one-sidedness in mental development early shows itself spontaneously in some cases. Krafft-Ebing[1] notes that children of nervous parents are very likely to show a one-sided brightness.[2] Ziller thinks that precocity almost always rests on unbalance, and Emminghaus[3] even gives as the definition of precocity a lack of mental equilibrium. The mathematical prodigies as a class are notoriously partial in their ability. Musical and theatrical prodigies also usually show partial development, their precocity being mostly emotional.

Granting, however, that unbalance is once in a while spontaneous and prophetic of more or less genius, it is not evident

[1] Ueber Nervosität, Graz, 1884.
[2] Grundlage zur Lehre vom erziehlishen Untrr., p. 477.
[3] Die Psychichen Störungen des Kindesalters, p. 9-10.

that the condition is one to be encouraged. The narrowing of interests and talent, even in adult life, to the close confines of a small department of one profession is rather an event to be deplored and to be postponed as long as possible. As Fuchs, Clouston, Krafft-Ebing, Ziller, Emminghaus, Baur, and Moreau de Tours have urged, teachers and parents should stand guard against every narrowing tendency. The child, as the epitome of the race, ought to represent in miniature the sum total of all human endeavor and aspirations. But if he shows unusual talent in one particular direction and is made into a parade horse on account of it, there is danger of developing a morbid conceit that will tinge the whole life. This seems to have been the result with most famous calculators. It is also true of several musical prodigies, of whom Mozart is a conspicuous example. In some cases the child who could have been fitted for a quiet and useful life in a moderate station is "staged" on account of some insignificant gift of nature, as for instance ability to perform feats of calculation or memory, with the result that all other interests atrophy, the personality dies out, the emotions are dried up, and nothing remains but a frightfully distorted remnant. Under this kind of treatment even the rudiments of common sense sometimes seem to disappear, leaving the subject practically an idiot in all respects except his particular gift. We must distinguish between the true *idiots savants* and those who are made such by foolish parents and teachers.

VIII. Precocity and Nervousness.

It is true that a large portion of the noted men of history gave precocious promise of their future greatness. It is also true that a large portion of these showed nothing abnormal or neuropathic in their development. On the other hand a few geniuses, as children were notoriously morbid. Moreover, of the vast numbers of precocious children who do not later become famous, perhaps most are of the nervously morbid type. It is possible, as Lombroso and his followers have emphasized, that their nervous endowment is similar to that of the real geniuses, only of slightly greater instability; that is, that nervousness and genius have a common basis in an exaggerated organic activity and nervous instability. If this condition is accentuated, lesions causing insanity or death are liable.

Types of morbid precocity have been described at length by several authors. Trüper[1] for example, says in substance: Among the nervously excitable there is no lack of apparently precocious intelligence. It is not real, however, but due only

[1]Minor mental abnormalities in children, Child Study Monthly, 1898.

to a fantastic and excitable imagination. They interrupt with all sorts of wise questions. They are restless as butterflies, are peevish and stubborn. They are parrot-like in their mode of learning. They are likely to show volitional defects. Commonly they are well gifted in language, and in general interested in words rather than things. The weakness lurks in concealment and only comes to light when the pupil is overloaded with subject matter of instruction. The matter is complicated by the foolish pride of parents. Worst of all, the teacher accepts these qualities as symptoms of genius in language, philosophy, etc., and is likely to encourage the pupil to continue his interest in book knowledge and formal instruction rather than adopt the far more sane method of restoring balance by the study of concrete things and by feeding the sense of reality.

Meyer[1] gives a similar description of the morbidly precocious: They are prematurely and one-sidedly conscientious, and often of exalted religious and moral standards. Precocious sexual development and grossly immoral sexual practices may accompany. They have à furor for abstract matters. They shun companions of their own age and cling to those who are older and can better feed their insatiable curiosity. They are irritable, erotic, whimsical and hypersensitive. They have headaches, freaky appetite and general malaise. They are egotistical, subject to fantastic day dreaming, and become too good for the world. They have little sociability, care little for games, and take more interest in words, books, and remote philosophical matters than in actual experience.

Féré, speaking of this type says: "One ray of the sun enlivens them, a cloud dulls them, an electric state of the atmosphere torments and overpowers them." He adds also that this ultra impressionability, is one of the first consequences of a morbid heredity. Mozart as a child was thrown into convulsions at the mere sound of a trumpet. His heightened self-consciousness was no less morbid. Many times a day he would ask those around him if they loved him. A negative answer much affected him. His extremely mobile physiognomy was never at rest and expressed incessantly either pleasure or pain. Clouston instances a boy of 7 years who was abnormally sensitive to specific sense stimuli, loud sounds and strong lights almost causing convulsions. Then he became hyperæsthesic morally and was haunted by the usual puerile fears of wrong-doing. After extended over-culture and after being put to a highly stimulating employment he developed adolescent insanity at 17.

---

[1] *Amer. Jour. of Psychology*, Oct., 1903.

Fuchs[1] accounts for a large part of the apparent brightness shown by children of unusual curiosity simply as an over-irritability of intellect and emotions. He thinks the question mania in its extreme form is not common to the healthy child. He marks how in one of his subjects during fits of it, the entire body shows the excitement. Speech is hesitating and stuttering, the arms jerk, and the legs make dancing movements. The more rapid and unhesitating the fire of questions, the more the bodily excitement increases.

Another boy cited by Fuchs has a precocious and hypertrophied sense of honor. The slightest joke or remark that touches his ego is resented with blows or oaths. He cannot rest till his honor is vindicated. Fuchs believes that such hypersensibility lies at the root of many child suicides. The false and heightened consciousness of self makes the subject always feel himself injured, and the result is a continual state of morbid suspicion, or in some cases criminal acts or suicide.

Torquato Tasso is the classic example of this type of morbid suspicion. It seems to have been true of his real life as well as his personality as depicted by Goethe in the drama by that name. Tasso's peculiarly neuropathic nature has made him a favorite subject of study for mental pathologists.[2] His life illustrates almost every phase of precocity and its connection with nervousness and melancholia. As a child he was extraordinarily precocious. His friend and biographer quotes an old nurse to the effect that he uttered some words when only six months old. From earliest childhood he showed an amount of sense and gravity beyond his years. The Fathers at his school made him take his first communion when scarcely 9, though both mind and body were at that time so mature that he might have been judged 12 at least. He was also sexually precocious. His mother dying early, the boy shared all the vicissitudes of his father's life—"a mixture of gratified vanity and humiliation, pride and dependence, poverty in sight of grandeur." With his precocious intellect and keen sensibilities, these distresses imbued him with a tinge of melancholy which followed him to the grave. The anxiety which his mother suffered before his birth and the griefs of childhood helped the development of his mental derangement. That he was of nervous constitution is also indicated by his stuttering. His exaggerated scruples were shown by his habit of troubling his friends with letters asking whether he had offended them, and by his suffering from fancied religious doubts. His vanity was so overfed by praise and honor in his early life that he owns he "could

[1] Beiträge zur Pädagogische pathologie, p. 57 ff.
[2] *Vide* Ireland: Alienists and Neurologist, 1891.

not live in a city where all the nobility did not either yield him first place or at least content themselves with a perfect equality in all exterior marks of honor." Later in life he developed his characteristic delusions of persecution, which, in varying intensity, remained with him through life and which have given rise to so much interesting controversy among his biographers.

Such characters are also frequently distinguished by excessive timidity. The timidity shows itself not only in excessive and insane fears, but in a kind of paralysis of the volitional powers; a devotion to the contemplative rather than the active side of life. At the same time the ambitions grow lofty in proportion as the inclination to try to realize them disappears. Conceit and pride in their ability to perform great deeds are inversely proportional to the likelihood of their accomplishing anything. The childhood of Cowper was rendered miserable by the depression caused by his acuteness of feeling and his timidity.

Mozart, Tasso, Cowper—these are only a few of many famous examples which could be given of precocity in connection with various neuropathic conditions. Marie Bashkirtseff should also be mentioned, for her Journal is a veritable text book on precocity. Under the best of conditions such constitutions are plentiful enough. The important question is whether the environment we furnish is the most suitable it might be for carrying such persons over the critical period of their development. The alienists and the students of children's defects and abnormalities are almost unanimous in the negative. They point out how, from the first weeks of life, the child is subject to over-stimulation. He is tossed and coddled and talked to. He is subjected to too great heat, light, and other intense stimuli. He is taught to walk and to gesture as though he would never learn these things of himself. He grows up among elders whose actions he is urged to imitate. Language itself, as Wundt points out, is precocious. It does not seem unreasonable to suppose that the results would be similar to those of hot-house culture of plants. In accordance with this, most investigators find that puberty is reached distinctly earlier in the city, where such conditions are at their maximum, than in the country. Along with the above, there is remarked a greater tendency to all kinds of nervous ailments. Mentally it tends to create the *blasé* type. The perpetual distraction of the attention makes for mental incoherence and therefore for imitativeness and shallowness rather than for personal resource and initiative.

The refined pleasures and love of luxury which children early become accustomed to, awaken prematurely the mania for sense satisfaction. Theatres, exciting reading, and the un-

guarded talk of elders contribute to the same effect. Sikorsky[1] emphasizes the danger of over-stimulation of mere babes. He cites the case of Preyer's boy, whose eye accommodation, on account of daily practice, developed in the unusually short space of 23 days. Sikorsky believes that even the ordinary sense impressions fatigue the child after a short time, and that strong stimuli are to be avoided at any cost. Our whole environment makes for unnatural living and nervousness. Instead of the field and hunt, we have the office, the pen, and the library. We do everything in a hurry. Trains, trolleys, telegrams—our whole civilization is on the run. Children are the worst sufferers. They have not yet become deadened to the thousand forms of stimulation. The nervous never become able to accommodate their senses. They are awakened precociously to the sensuous life. There are children's balls, children's parties and children's newspapers. In cities, especially, we no longer find real children, but small adults.

Krafft-Ebing thinks that the kind of female education that we give is worse than none. Instead of training girls to become mothers, they are trained to appear brilliant in society in order that they may marry well. To this end they are introduced into society far too early. Their general education is shallow. The heart is neglected. Without regard to whether they have musical talent, they are made nervous by premature practice on the piano.

In this connection it may be remarked that a renowned Berlin physician, from observations on 1,000 girls who began piano practice early in life, finds that 600 developed serious nervous troubles. He sets 16 years as the minimum age at which practice should begin.

Dr. C. Pelmann[2] takes a view much like that of Krafft-Ebing concerning the effect of cities, hurried life and sense stimulation upon the development of nervousness. He finds on all hands recklessness in the expenditure of energy, and of all countries he regards America as the most reckless and nervous stricken.

Dr. Willy Hellpach[3] regards our mad rush for wealth, our ways of using wealth, our art and æsthetic culture generally, and the modern sexual aberrations as only so many symptoms of a deep-seated nervousness that is ever growing worse.

Féré suggests that we have summation effects in emotions as well as in pure sensation and the simpler feelings. The hurry and bustle and continual strain, every corner of life adding its

[1] Die Seele des Kindes, p. 31.
[2] Nervosität u. Erziehung.
[3] Nervosität u. Kultur, Berlin, 1902.

mite, causes the nervous system finally to become exhausted and to drop into a state of chronic irritability.

Allowing liberally for the exaggeration and partiality of the above indictments, it is yet impossible to regard them as entirely groundless. What can be done? One thing is certain. The cry of "back to nature," so often iterated, will never be heeded. The complexity of civilized life will remain; and along with it the dangers and difficulties of bringing the children into timely *rapport* with it.

Plants and animals, for the most part, are left to a natural course of development, except when subjected to forced culture at the hands of man, or when now and then hurried by unfavorable environment to a stunted maturity. Unlike these, man is never left to a natural course of development, and in the nature of things cannot be. The plane he must reach in a few short years is so infinitely separated from his animal origin that he cannot cross the gulf by his own efforts. Even if he could, circumstances would not allow of his doing so. The child being imitative and sentient, the mere presence of others exerts a powerful influence over his rate of development; just as Mill found that suggestive action among a litter of puppies greatly hastened their progress as compared with that of the puppy kept apart. The ideal of Rousseau cannot be reached in practical life. But the conditions are certainly worse than they need to be. Infancy and childhood can at least be protected from the grosser agencies of prematuration. The strenuous life can at least be postponed till the danger of nervous breakdown is lessened. Educational practice can lay less stress upon intellect and more upon feeling and volition. And finally, life ideals can be so transformed that one may live the simple life even in the midst of the complexity of modern environment.

IX. Sexual Precocity.

No other phase of precocity is so important as that related to the premature development of the sexual functions, and no other is so difficult to treat. Many of the facts are such as cannot here be presented in detail even if lack of space did not prevent. Moreover, the establishment of norms, everywhere of vital importance in a study of precocity, offers in matters of sex, difficulties that are practically insurmountable. This paper, therefore, can do little more than emphasize a few points most of which are obvious, but which many teachers and parents are strangely ignorant of or still more strangely ignore.

1. *Cases of Extreme Sexual Precocity.*

Ploss[1] describes 42 cases of precocious menstruation vary-

[1] Das Weib, p. 239 ff.

ing from 9 years down to a few months. Carrière,[1] collects 56 such cases and describes them in so far as records could be obtained. 20 of these were under 1 year, 11 between 1 and 2 years, 11 between 2 and 3, and the rest ranging up to 8 years. 21 showed in greater or less degree the usual secondary sexual characters. Dr. J. L. Morse read a paper before the Obs. Soc. of Boston, Jan. 19, 1897, on precocious maturity which was based on the reports of about 60 such cases. Now and then, but more rarely, male children are subject to the same strange rapidity of development. Sturgis[2] cites 7 cases and describes them in full detail. All of these cases were under 5 years of age and all showed unusual development of secondary sexual characters. Dr. Townsend,[3] Mantegazza,[4] Féré,[5] Fuchs,[6] and Ausset,[7] have together cited about 12 other cases, both male and female. Several of the above reports are no doubt duplicates, so that possibly not more than 75 to 100 different cases are reliably reported. Almost nothing is known of the etiology of sexual precocity of this kind and few cases have been followed up in later life. Hydrocephaly and rickets sometimes accompany, but not often. A few are known to have lived to adult life and become parents. These cases of extreme precocity cannot be accounted for by supposing premature sexual excitation. They are plainly congenital, and the unusual acceleration can reasonably be supposed to date back as far as the very first stages of embryonic development. Precocious dentition offers similarly strange anomalies, but unlike precocious sexuality, has apparently no bodily correlates. It seems in no way related to sexual precocity. Both phenomena are interesting, but to the physician and biologist rather than the psychologist or educator.

2. *Precocious Excitation of the Sexual Instinct and its Dangers.*

Leaving out of account such abnormal sexual precocity as the above, with which environment and education have had nothing to do, emphasis must be laid upon the indubitable fact that even in normal, healthy children the sexual instincts are often aroused very early. I cannot agree with those who explain the love affairs of children as a matter of imitation or as a result of bad training. This will account for only a part. It would be an ideal state of affairs if the consciousness of sex differences and functions could be kept slumbering throughout

[1] De la Précocité Physique et Intellectuelle, Paris, 1901.
[2] Sexual Debility in Man.
[3] Boston Med. and S. J., 1897, p. 231.
[4] Hygiene der Liebe.
[5] L'instinct Sexuel.
[6] Jahrbücher f. Psychiatrie, 1903, p. 207.
[7] L'Écho Méd. du Nord., 1901, p. 293.

childhood and only allowed to waken gradually with the growing ripeness of youth. Such is the course of development which the sexual instincts take in many children. On the other hand, there are other children too numerous and too healthy to be called abnormal, whose development follows a radically different course.

I have been personally assured by a few educated, cultured, and healthy men that as children they experienced the emotions of sexual love as early as 6 to 8 years. They have further assured me that the emotion could not in their cases be accounted for by imitation or faulty training. Havelock Ellis says: "I find, on eliciting the recollection of normal persons, that in some cases there have been voluptuous sensations from casual contact with the sexual organs from a very early age, in other cases complete sexual anesthesia till puberty." One woman whom Ellis reports states that her sexual passions were stronger at 13 than at any other time in her life. Mr. Bell[1] traces the sexual emotion in a few cases as low as the middle of the third year, and finds abundant evidence of it as early as the sixth year. At the latter age, love fetishism appears. Gifts assume an acquired value. Refractory pupils become docile in the presence of the loved one, cowards are made brave and beauty serves as the attraction. "The unprejudiced mind in observing the manifestations in hundreds of cases cannot escape referring them to sex origin." Mr. Bell admits that the emotions at this early age are not usually specifically sexual in the sense of being accompanied by erethism of the sexual organs. But as Mr. Bell says, and as others have pointed out, erethism is not confined to any particular organs. Children do have the heightened vascular and nervous excitement. "They have a state of exaltation erethic in its nature, massy, vague, and distributed throughout the whole body."

Indeed, we ought not to expect anything else than that childhood should show lively premonitions of the passions more peculiar to adolescence. The body does not pass in a day from childhood to puberty and adolescence, and why should the emotions? The boy of 12 is vastly more like a man than the boy of 8, in every organ. The sexual functions have not established themselves and yet the organs have at no time been in a quiescent state as was once thought. Previously to 1887 the evolution of the sperm forming elements in man and the higher vertebrates was divided into four periods. The first two were preliminary, in the early stages of the embryo. The third embraced the latter part of fœtal life, infancy, and childhood up to puberty, and was supposed to be a period of repose.

[1] *Amer. Jour. of Psychology*, 1902, p. 325-354.

The fourth, was the period of *spermatogenèse* strictly speaking. But in 1887 M. Prenant demonstrated that the latter period was preceded by a brief phase, which he called *prespermatogenèse*. During this period the semeniferous epithelium is formed and instead of secreting sperma which live, it only forms elements which degenerate and disappear by reabsorption.[1] Moreover M. Loisel reports a careful study he himself has made of the testicles of young birds, which demonstrates that in birds, at least, no long period of repose exists. Loisel sums it up as follows: "In fact from the moment when the semeniferous epithelium is formed, there is a succession of rapid periods of development, of aborted sexual crises which normally disappear before puberty. If the evolution of the testicle of mammals is similar to that of birds, which is probable, we find here an explanation of cases of sexual precocity in man. We have only to suppose that one of these spermatogenetic crises may go farther than it normally ought to go."

Here we would seem to have, if not a complete and final, at least a tentative and partial, explanation of most cases of premature functioning of the sexual organs.

Mantegazza and Ferriani have come to the conclusion that sexual love often stirs the child even more severely than the adult. Speyer[2] is led to the same conclusion and thinks it very important with many children for careful oversight in these respects to begin quite early. The following are some children's love letters which by chance fell into his hands.

1. Letter from a boy of 9 to his sweetheart.

"Liebe Anna! Du weisst ja dass ich Dich liebe, wenn Du aber dabei bleibst mir immer nein zu sagen, breche ich Dir die Rippen entzwei. Inzwischen küsse ich Dich."

2. Girl of 12 to a married man of 22.

"Ich liebe Dich, ich bete Dich an, und will, dass Du mein seist, mein, mein, mein, mein ganz allein, mein Gatte, meine einzige Liebe; wenn Du nicht einwilligst, werde ich mich schrecklich rächen, und sollte die Welt auch daran zu Grunde gehen."

3. Boy of 13 to a 15 year old girl.

"Wenn Du mich nicht lieben willst, zerfleische ich Dir das Gesicht; nimm Dich in Acht, ich bin im Stande Dich zu töten."

4. Boy of 13 to 13 year old girl.

"Du wirst mein sein, oder ich bringe Dich um! Ich bin eifersüchtig und könnte Dich töten."

---

[1] Reported by Gustave Loisel, Comptes Rendus, Vol. CXXXI, p. 725 ff.

[2] Speyer: Die Liebe bei den Kindern, Die Kinderfehler, Oct., 1903.

5. Girl of 9 to 36 year old teacher.

"Ich bete Dich an wie die Engel im Paradies Gott anbeten. Liebe mich, sonst sterbe ich vor Gram."

6. Girl of 12, of noble family, to boy of 15.

"Ach mein Gott, was muss ich leiden, wie habe ich weinen müssen, als Du gesagt hast, ich wäre eine Herumtreiberin! Warum quälst Du mich so? Siest Du denn nicht wie ich leide, wie elend ich werde? Ich schlafe nicht mehr, ich esse nicht mehr. Ach Gott! Ich fühle es, wenn Du mich nicht liebst, werde ich mir das Leben nehmen, ich thue es ganz bestimmt. Und wenn ich einst tot bin, wirst Du mir eine Rose auf mein Grab pflanzen."

7. Girl of 10 to a boy of 12.

"Du bist mein einziger Gedanke, Dich sehe ich überall, beim Spiel, bei der Arbeit, beim Essen, und mit Sehnsucht erwarte ich den Beginn der Ferien, um Dich zu umarmen und Dir zu sagen, dass ich für immer und ganz Dir angehören."

One recalls also that Byron was in love with Mary Duff at 7 years of age, Dante with Beatrice at 9 and Marie Bashkirtseff with the Duke (to whom she had never spoken) at 13. Alfieri, Rousseau, and Canova were likewise lovers in childhood.

Finally, if the feelings of sex love did not normally reach an initial stage of development in childhood, or if they were not lying in wait, as it were, ready to break forth at the least provocation, it would be difficult to account for the alarming prevalence of perverted sexual practices among children. Every scientist who has made a careful study of the subject has given evidence of the wide-spread existence of these practices, not only among children degenerate and uncared for, but also among those of sound heredity and cultured homes. The evidence is convincing that a good portion of those of perverted sexuality acquire their practices long before they have reached an age when most people regard oversight as necessary. Mantegazza finds that they often begin as early as the first attempt at speaking and walking, and he advises that every child should be carefully watched from the cradle up. Metchniakoff notes that sexual perversions are common in children under 5 years of age. Havelock Ellis finds that there is absolutely no age limit, and gives examples of its occurrence in mere babes. The studies of Rohleder, Walter Bensemann, Alfred Fournier, and Cohn have shown that this subject is one of the most burning questions of school hygiene in England, Germany and France.

These authors agree, 1st, that the extent of such practices in the public schools is terrifying; 2nd, that the worst age is from about 12 to 14, but that no school age is exempt; 3rd, that the danger of crowding young and old pupils together in

the public schools is fraught with the greatest danger. The writers on pedagogical pathology have noted the frequency with which pupils in the higher classes choose "lovers," of the same sex, in the lower classes, whom they instruct in all sorts of mutual manipulations. Fournier goes as far as to give this practice a special name, *l'inversion scolaire.* 4th, they further agree that conditions are immensely aggravated by school life, with its long hours of sitting, bodily neglect, hot stuffy rooms, bad ventilation, excitements for the imagination, unpurged classic texts, the memory grind and artificial emphasis on the acquisition of knowledge rather than right habits of feeling and acting. As Fournier puts it, the education which the youth receives in our modern society, and which has for its chief aim a rapid development of the mental powers, seems to be favorable to bad sexuality. Rohleder believes that it is those pupils whose mental powers make the greatest daily strides that are in the greatest danger.

Considering the light recently shed upon the subject of sexual inversion and the evidence of a hitherto unsuspected number of inverts, it is interesting to note that Ellis, Kraepelin, Oppenheim, Raffalovich, and Braunschweig all emphasize precocious sexual perversions as a factor in producing sexual inverts.

3. *Factors of Precocious Sexual Maturity.*

The evidence is overwhelming that man can be subjected to various conditions which will hasten or retard sexual maturity. Some of these factors are heat, light, food, climate, physical irritants; whether external like friction of clothing, or internal like tumors; sense stimulations, social surroundings, physical activity, mental training, etc. One of the most striking facts is that a large majority of investigators find puberty in both sexes earlier in the city than in the country. On account of race differences, differences in climate, and other factors, one must of course guard against unwarranted conclusions, but after liberal allowances are made, the above conclusion is unavoidable. The average age for 129 city bred girls[1] was 13.72, *i. e.*, "nearly one year younger than Playfair and Lusk give as the average age for girls." 4,872 boys and girls in St. Petersburg and vicinity showed decidedly earlier age in the city than in the country, and among the wealthy than among the poor. W. V. Zab, from observations of 4,245 Russian gymnasial students, found puberty about 1½ to 2 years earlier than among the rural population. Kakuskine gives as the average age for Russian girls in the city 14.9 and in the country 15.3. In

[1] Helen Kennedy: *Ped Sem.*, Vol. II, p. 470.

Hanover 2,129 observations showed an average age of 16.76 for the city and 17.03 for the country. Lullies[1] on 3,000 observations of Prussian girls finds puberty on the average six months earlier in the city. On this point, however, there are conflicting observations and the matter cannot yet be regarded as fully certain. Observations furnished the writer of 287 girls in two normal schools and one private school of the Middle Atlantic States give a decidedly lower average for the country than for the city. We are here, however, dealing with a selected class, among whom doubtless the evil effects of city life would be at a minimum. The difference was almost 6 months.

There is no doubt that specific sexual excitation makes for precocious puberty. Dr. Warken[2] reported observations on 42 women of the well-known Oneida community who had practiced sexual relations from an early age. The menstrual function was established in 12 of these as early as 12 years, and in one at 10. The extraordinary precocity of girls in India has been attributed to the influence of child marriages and the accompanying sexual stimulations at the premature age of 10 or 11 years. In India, according to the laws of *Manu*, a 24 year old man is suited to an 8 year old girl[3] and one of the three impurities which cannot be atoned for is for a girl to be unmarried at 18. In some districts of India it is regarded as a disgrace to allow the first menstruation to occur in the father's house, *i. e.*, before marriage.

That not only specific sexual stimulation, but even precocious interest in sexual affairs hastens the onset of puberty is testified by Féré, Friederich, Dencker, Joubert, Beneke, Acton, Scott, Carrière, Brass, Bergemann, Mantegazza, Ellis, Viasemsky, and others. Several writers have noted that precocious menstruation more often occurs with the younger daughters in a large family of girls; supposedly because their interest in the matter is heightened by their knowledge of the functions in the older sisters.

As emphasized by Mosso, Dencker, Bergemann and others, it is important that the sexes be allowed to mingle freely in school and play during childhood. It seems that those countries where the sexes are very early separated in school and otherwise give most evidence of perverted sexuality among children. The separation places an artificial emphasis on sex differences, and leaves the imagination to supply morbid ideas which would be sanified by a closer knowledge of the opposite sex gained through everyday contact.

---

[1] This and the above references quoted from Pres. Hall, Adolescence, Vol. I, p. 475.

[2] Am. J. of Obstetrics, p. 785.

[3] Ploss: Das Weib, p. 385.

Among other causes of sexual precocity, Dencker mentions rich foods, stimulants like tea and coffee, premature excitement of the fancy, and over-emphasis of the intellect. Viasemsky mentions rich foods, too warm clothes, too soft a bed, high temperature, and all things that aggravate nervousness. Friederich emphasizes mental fatigue as a predisposing element. Scott mentions the theatre, impure literature, and food stimulants. Beneke lays stress on the prematuring effects of modern systems of education. Brass thinks that everything which excites pleasantly tends to hasten sexual development. In harmony with this, Féré finds that a certain degree of mental and physical exaltation usually accompanies it. Acton emphasizes the effect of mechanical irritations, such as rectal irritation from worms, oversensitiveness of bladder, and irritation of the external organs from morbid secretions, slight deformities of prepuce, etc. In this connection may be mentioned the oft quoted example of Marro, of a boy who since the age of 5½ years had suffered from a tumor in the left testicle. By 9½ years he had acquired all the striking secondary sexual characters of mind and body which come with true puberty, even to the change of voice. On removal of the tumor, the voice became childish again and all the other marks of sexual maturity disappeared.

It must be acknowledged that the evidence for the importance of most of the above factors is partial and must ever remain so. The conclusive experiment of subjecting human beings to them under controlled conditions will never be made. But as man is no longer considered apart from the rest of animal creation, and even his kinship with plant life is recognized, it may be profitabe to draw some biological analogies bearing upon these same questions.

As to the effects of temperature and climate the following are a few of the observations that have been made: Animals of wide latitudinal distribution are usually largest in the centre of distribution and decrease in size both northward and southward.[1] Of butterflies which produce three generations yearly, the first two generations produced in the summer, come to quick maturity, while the last generation are retarded by the cold of winter and only complete their development on the return of spring.[2] Weismann[3] reports extensive experiments of his own and others on the effects of heat and cold on the development of butterflies. All find that in most cases the development is accelerated by one or two months. In a few cases, however, the effect was not marked. Standfuss exposed

[1] T. H. Morgan: Evolution and Adaptation, 1903.
[2] Orr: A Theory of Development and Heredity.
[3] Studies in the Theory of Descent, Vol. I.

the eggs of butterflies to a temperature of 34° C, and succeeded in producing the larval state in two-thirds the normal time, and strange to say, the larval state was also shortened although the high temperature was applied only to the eggs. Helen Dean King[1] finds that in the early stages of the development of toad's eggs, a very slight degree of heat is sufficient to cause marked acceleration. E. P. Lyons, in experimenting with artificial parthenogenesis,[2] finds that temperature is very important, and chiefly in affecting the *rate* of development. R. Malling-Hanson[3] comes to the conclusion that the variations in the increase in weight of children run parallel in the variations of the sun's warmth. Daffner also finds that warmth of climate has marked accelerating influence on human growth. In agreement with this, most anthropologists agree in ascribing an earlier puberty to southern than to northern races. The rate of growth in the ear of the rabbit has been experimentally increased by the application of high temperature, while low temperature retards its growth. De Varigny[4] finds that the growth of trees is greater in the south than on the north side. Vernon finds that temperature is an important element in the moment of fecundation of the eggs of sea urchins. A certain temperature held for only a minute at that time was equal in effect to the same temperature held during 8 days of embryonic development. Rohleder finds that nymphomania and involuntary pollutions are aggravated in the spring.

The accelerating and retarding effects of foods are also familiar to the experimental biologist. Bees regulate the birth of queens according to their possible desire for a second swarm, a third, or even a fourth; the diet being so administered that no two will be hatched simultaneously. De Varigny finds that tadpoles do not grow as large when crowded closely together in small ponds. Davenport[5] gives the same statement along with a mass of other curious and interesting information concerning the effects of phosphorus, sulphur, iodine and other food stuffs. The effects of thyroid diet are too well known to need mention. A score or more of experimenters have also been able to produce accelerations of growth both in plants and animals by applications of electricity and by various mechanical irritations. There is some evidence that summation effects begin as far back as plant life. Davenport interprets in this way the extraordinary irritating effect produced on a certain plant by placing an insignificantly small rider on one of its tendrils.

---

[1] Effects of Heat on Development of Toad's Eggs. Biology, Bull., 1903.
[2] Am. J. Physiology, 1903, p. 315 ff.
[3] Perioden im Gewicht der Kinder u. in der Sonnenwärme, 1886.
[4] Experimental Evolution, p. 198 ff.
[5] Experimental Morphology, Vol. II, 1899.

As to domesticity and improved breeding, Darwin and other observers since him have observed the prematuring effects. Cows, horses (especially race horses), sheep, and likewise many domestic plants are far more precocious than those in the wild state.

In the light of the above observations and many more which could be cited, it seems probable that there is at least some basis for the assertions quoted above concerning the effects of temperature, foods, clothing, crowded life, etc., in hastening sexual maturity in man. The claim is not made that the amount of sexual precocity is great if measured in years, nor that it occurs in every child. The consequence is momentous enough if the precocity exists in any degree in even a small number of individuals. It has been shown by the alienists to be often connected with adolescent insanity, and by the criminologists to be a frequent accompaniment of precocious criminality. Whether the suspected relation of cause and effect exists, or whether the one series of phenomena is only a symptom of the other, or of a more underlying pathological condition, the fact of concomitance is, in either case, important.

This, as well as every other division of our study, points to the conclusion that the prime object of our education ought to be a delaying of mental maturity. Up to 10 at least, the smallest amount of mental together with the greatest bodily occcupation should be the rule. The opposite course makes for morbidity, self-consciousness, nervousness, unbalance, religiosity and later cynicism, criminality, bad sexuality, or suicide,—all owing to the physiological and neurological concords that are present to be played upon.

The problem is largely to strengthen the volitional powers before the onset of puberty. Only a strong will can guide the human bark through the storm and stress of adolescence. In so far as the will has a basis, it is the motor apparatus. One-third to one-half of the brain surface is motor. It is reasonable that neglect of those centres may lead, as Gulick points out, to an over-functioning of the association centres. In neglect of all these things, we have lengthened the hours of school work and taken away largely the opportunity for physical development. As Gulick warns us[1] we thereby at one stroke both take away the safeguards against, and increase the danger of, sexual precocity, by heightening the sensibility of the nervous system; further, that in civilized life, generally, we have less muscular exercise and more pampered ways of living; and "just as animals in the wild state are hardy and are made slug-

[1] Safeguards for Boys. The Assoc. Outlook, 1898.

gish and precocious by domesticity, so it is with man in the biological furnace."[1]

In conclusion, the reader is urged to remember that the converse side of this question is just as important for education as is the phase here presented. The existence of nascent stages involves two dangers. Particular instruction or training may be given either too early or too late. To treat the effects of the latter will require another paper. The former has been chosen for treatment first because it is the danger that educational literature has most neglected.

This subject was proposed by President G. Stanley Hall, to whom also I am indebted beyond measure for innumerable suggestions, for the loan of rare books and most of all for his hearty sympathy and encouragement. I am indebted to the other members of the Clark University faculty, and particularly to Dr. Theodate Smith, for suggestions and for assistance in the collection of data. My thanks are likewise due to Mr. Louis N. Wilson and his library assistants for their generous co-operation.

[1] *Vide* Physical Education by Muscular Exercise, 1904.

ANENT PSYCHOPHYSICAL PARALLELISM.[1]

By Edmund Montgomery.

In order to overcome in this connection the repugnance naturally attaching to the seemingly materialistic view, that our conscious content is a functional outcome of what is perceived as our organism, it may be well to recognize on what actual foundation the apparently trenchant dualism of body and mind is in reality based.

Let, then, a definite conscious content arise out of latent memory to fill the actual moment of awareness of a certain subject perceived by an outside observer. This conscious content will be all in all that is directly and subjectively revealed or present to him. On the same occasion in the outside observer, on the other hand, through roundabout means of definite sensorial stimulation, an entirely different conscious content correspondingly arises. He distinctly perceives a body or organism, and would, in case his vision happened to be sufficiently penetrating, moreover, become aware that in the brain of the perceptually revealed organism there is occurring a definite functional commotion.

From this undeniable state of things it follows, that the perceptual organism within the conscious content of the observer cannot possibly belong to the observed subject, cannot be the subject's real organic being. Nor can the perceived functional brain-commotion, forming likewise part of the observer's conscious content, be the real functional activity which is causing the emergence of the totally different conscious content in the observed subject. Hence the irreconcilable duality of body and mind. For what is here called the bodily organism is really a percept which may form part of the conscious content of any outside observer, or of any number of such observers. While what is here called mind is the exclusive conscious awareness of the observed subject. In this light it becomes evident why such a body cannot emanate mind, and why such mind cannot move or actuate what is perceived as body.

The observed subject can, of course, likewise become aware of the perceptual body, just as the observer, by means of sense-

[1]Extract from an unpublished work entitled "Philosophical Problems in the Light of Vital Organization."

stimulation. It is true, this body, though forming equally with other bodies part of his conscious content, is felt quite particularly to belong to himself. This, however, is due to inner or organic sensations spatially corroborating the externally stimulated sensations of sight and touch. I feel by means of inner sensations what is called my hand to be occupying a definite position in space. Through sight and touch this inner experience is corroborated in perceptual awareness, and *vice versa*. But the perceived body or organism is here, also, like all other perceived bodies, only a transient constituent of the conscious content, and is nowise the real organic being.

From the same actual state of things it can be furthermore rightly concluded, that it is an extra-conscious activity within the extra-conscious being of the perceptually revealed subject, which causes his own moment of awareness to be filled with a definite conscious content, and which simultaneously causes to arise in the observer's perceptual awareness a corresponding functional brain-commotion. The observed subject's conscious content is thus proved to be a functional outcome of his real extra-conscious being, and not of that which is only vicariously and symbolically revealed as the perceptual organism forming part of the observer's conscious content.

The perceptual organism and its functional brain-commotion within the observer's conscious content has obviously nothing whatever to do with what actually occurs within the observed subject. It has no effective influence on the same, although it vicariously and symbolically reveals the presence, characteristics and activities of the real extra-conscious being of the observed subject.

It is clear, moreover, that the perceptual organism, forming part of the conscious content of the observer, is not only not a material body, as is generally taken for granted, but that it is, on the contrary, out and out of the same forceless, evanescent, psychic consistency as the transient conscious content of the observed subject. There obtains here absolutely no duality of nature between mind and body, for the organism actually and bodily perceived is just as much a psychic phenomenon as the conscious content of the observed subject.

It is evident, however, that the perceptual organism and its definite brain-commotion is aroused in the observer by stimulating influences emanating from the real power-endowed, extra-conscious subject he is observing, and that it reveals therewith with vivid precision, though vicariously and symbolically in terms of perceptual consciousness, its presence, characteristics and activities.

As to the observed subject's own conscious content, consisting, as it does of a complex of feelings, sensations, perceptions,

emotions, volitions and thoughts, it is like all modes of consciousness utterly forceless and evanescent, a mere content of lapsing time with no power whatever to stimulate the senses of observers, or to influence other existents in any direct manner. A being consisting of nothing but what is actually experienced as psychical would be wholly imperceptible to observers, wholly non-existent and non-efficient.

The epistemological explanation here given of the apparent duality of body and mind, notwithstanding their real sameness of nature as being both mere conscious phenomena; this explanation based on undeniable facts solves an ancient and obdurate riddle, and renders evident that it is a real extra-conscious, power-endowed existent perceptually revealed as our organism, that is the veritable bearer, veritable actuating matrix and manifesting agent of our all-revealing conscious content. This, our real being emits directly, from within, our own conscious content; and indirectly, through roundabout external sense-stimulation, it compels also its perceptual representation in observers.

The observer's perceptual awareness of the organic body constitutes its physical sense-stimulated aspect. And it is this perceptual organism which is the direct object of biological research. A biological investigator has consciously before him as direct object of research only his own sense-stimulated percepts. If these did not reveal the real existence of an extra-conscious being, he would then be investigating nothing but his own unaccountably arising conscious states, and pure solipsistic phenomenalism would be the consistent outcome of such a state of things.

The all-revealing conscious content, within whose moment of actual awareness may become microcosmically concentrated a vast complex of remembered experience, inclusive of social and ethical consciousness, constitutes the stupendous object of introspective investigation, and this regardless of the assistance of directly sense-stimulated awareness; save, indeed, that of silently self-articulated linguistic signs. By remembering thus the experience denoted and connoted by the linguistic or conceptual signs, latently gathered and systematized knowledge can be ratiocinatively summoned into actual awareness. And this has been the all but exclusive method of rationalistic philosophy, inclusive of rationalistic psychology.

Another introspective method of psychological interpretation has lately been attempted, one of an extreme phenomenalistic nature. Analyzing the conscious content, as such, irrespective of what its constituent elements denote, connote or signalize beyond themselves, the juggling effort is made to extract rational, nature-explaining sense out of their own direct

relations, as they are actually composing the conscious content. In the conscious content there arises, however, a medley of more or less disconnected phenomena which have no rational meaning or import whatever in themselves. A fictitious permanency and efficacy is here, as in the Association-Philosophy, attributed to single segregated constituents of the conscious content, while in reality the entire moment of conscious awareness is a forceless flowing and evanescent phenomenon in time, which has from moment to moment to be renewed through functional activity of our extra-conscious being. But even by taking the conscious phenomena of succeeding moments of time, perceptual bodies for instance, as identically abiding existents; even then phenomenalistic psychology can make no sense of mere conscious phenomena. The visually revealed perceptual organism, for instance, is in itself nothing but a definite complex of peculiarly shaded and colored spatial forms. In what rational relation can it possibly stand as such to other perceptual bodies simultaneously perceived; to a perceptual dinner, for example, consisting likewise of definitely shaded and colored spatial forms? All phenomena forming part of the conscious content receive their rational meaning by denoting, connoting or signalizing something beyond their own phenomenal existence. Even a mere feeling of pain or any mere organic sensation; conscious states these which are of all the components of the conscious content the least indicative of something beyond themselves; these even refer to definite occurrences within the extra-conscious organic being, which occurrences may become perceptually revealed. And these sensations may also revive the remembered perceptual appearance or the representative idea of the organ in which the feeling or sensation arises; the tooth which pains, the heart which beats. One and all conscious states rationally imply something beyond themselves, which they consciously signalize.

There is still another, and this the most positive method of psychological investigation, which may also prove to be the most instructive; the method, namely, employed in experimental psychology or so-called psychophysics. Here the experimenter has before him the vital organism of a conscious subject, together with an array of sense-stimulating devices. All this forms, as perceived by him, part of his conscious content signalizing real extra-conscious existents. And he is himself ready to use all requisite faculties of his extra-conscious being in order to gain psychological knowledge by means of experimentation. His aim is to induce definite psychic reactions or responses in the observed subject, whose senses he is stimulating in specific ways.

The difficulties and complexities in the way of this experi-

mental method may be appreciated by considering that the sense-compelled percepts, their attentive apprehension, the comprehension of their significance, the awakening thereby of organically associated conscious phenomena from out the vast store of remembered experience, which phenomena may be of more or less mere individual import; all this commingles here within the observed subject severely to tax the ingenuity and acumen of the experimenter. And he has nothing to base his judgments upon but the voluntary motor signals given by the observed subject, which he has, moreover, to interpret introspectively by means of his own conscious experience.

Psychology may legitimately use three different sources of information, which corroborate one another in the interpretation of the conscious content, whose present moment of awareness contains all we actually experience. The psychologist can introspectively analyze this all-revealing conscious content into its component constituents, such as feelings, sensations, perceptions, volitions, emotions and thoughts or ideas; or more succinctly into affections, cognitions and conations. And by reviving memorized and systematized experience by means of linguistic signs, he is able logically to deduce particular facts of experience from conceptual generalizations. This consciously remembered system of experience receives, however, its real significance from referring to extra-conscious existents and occurrences inside and outside the conscious being. The sensation of hunger, for instance, indicates an inner organic need; sense-compelled percepts the presence and characteristics of outside existents.

The second source from which psychology may derive most important information is that of compelled perceptual awareness, which reveals vividly the extra-conscious organic being, with the vital structures and functions whence the conscious content arises. Here direct experimentation elicits definite vital functional reactions on definite incitement. And by eliminating definite vital structures it gains instructive information, not only of physiological, but also of psychological import.

The third source of information is that afforded by the conscious subject when exposed to psychophysical experimenting and questioning.

The first source of information can be amplified by taking children and defectives under consideration. The second and third by comparing results attainable throughout the entire scale of animal life.

By judiciously utilizing all three sources of information a correct scientific interpretation of our all-revealing, but utterly forceless and phenomenal, conscious content may in time be attained. It can be fully understood, however, only as signal-

izing real modes of existence beyond itself, and as being a functional outcome of the vital organization of our real, extra-conscious, power-endowed being, which is the only genuinely substantial being in nature. For it alone has the power to reintegrate itself to essential identity of structure and function under a constant flow of change, without which identical restitution there would be no coherence nor steadfastness in life, in mind, and in the nature we have conscious awareness of.

It is the sense-revealed vital being that feels itself and its organic needs from within; that perceives itself and its environment by means of sense-stimulation, that is emotionally moved by recognition or anticipation of the sources of its pleasures and pains; that volitionally actuates its purposive movements in order to attain fruition or avoid danger; that concentrates within its momentary thought the systematized results of remembered past experience as guidance for its present and future conduct.

SONG AND CALL-NOTES OF ENGLISH SPARROWS WHEN REARED BY CANARIES.[1]

By EDWARD CONRADI, Ph. D., Fellow in Clark University.

It is well known that song birds can be trained to sing other songs than that of their species. It is held even that song in birds is largely, if not entirely, a matter of imitation. Daines Barrington, on the basis of numerous experiments, says that they seem to prove decisively that birds have no innate ideas of the notes which are supposed to be peculiar to each species. Morgan says that though we may not yet unreservedly accept the view that the song of birds is wholly a matter of imitation, with little or no congenital tendency to sing true to type, yet it is an established fact that imitation is an important factor.

Mr. C. A. Witchell says that it is clear that birds inherit the desire and power to sing, and style of song, and that some definite cries are perpetuated solely by the same agency. He says that it is certain that the call-notes of the fowl, pheasant, turkey, partridge, duck, goose, and "common shelduck" are inherited, that, whether reared naturally or artificially these birds are equally willing and able to employ them upon the appropriate occasions; that those of the pigeon, cuckoo, crow and his allies, hawks and their allies, and others of limited voices, are probably inherited, but may be transmitted by imitation. He thinks that call-notes and danger-cries play an important rôle in the song of birds. He finds that many species have their call-note repeatedly recurring in their song, that many good singers frequently construct whole phrases of a repetition of single cries, and that the goldfinch, the house-sparrow—for undoubtedly the latter occasionally tries to sing, he says—and the linnet appear to construct their song wholly of call-notes and of danger-cries. He says that his evidence shows that the songs were, at first, mere repetitions of call-notes, or possibly of defiance-cries which have since been more rapidly uttered and varied with the result that novel strains have been slowly developed. Darwin's theory that bird-song is a charm or a call-note addressed to the female, he thinks is true during the breeding season, but holds that the first songs of immature birds such as the young skylark, robin and

[1] This study was undertaken at the suggestion of Dr. C. F. Hodge, to whom I am under great obligations for much valuable assistance.

thrush, cannot reasonably be considered to be directly occasioned by the emotion of love.

Witchell finds that imitation is very prominent in bird song. Birds in their wild state do not only imitate other birds, but also insects, quadrupeds and sounds produced by the elements. A few of his illustrations will make his point clear: The voices of the owls simulate the moaning of the wind in hollow trees, such as these birds frequent; the *swee ree* of the common swift is similar to the swish of his wings as he skims through the air; the voices of mallards, pelicans, flamingoes, and herons resemble the croaking of frogs and toads. In British Columbia he heard a wren imitating perfectly the trickling of water. Moreover, many of the warbling birds build their nests not far from water, probably on account of the insect supply, and are thus often within hearing of the intricate music of babbling brooks. He thinks that such birds as the robin, wren, hedge-sparrow, blackbird, and blackcap which sing mellow tones and intervals of pitch rather than imitations of other sounds, may have acquired this music partly through the influence of the murmurs and gurgles of rippling streams. The common call-note of the "brown wren" resembles the chirp of the cricket—this bird is generally found along hedge rows where crickets abound and thus hears the cricket's chirp by day and by night. The song of the "grasshopper-warbler" is exactly like the persistent song of the green field cricket. The cry of the ostrich resembles the roar of the lion, and the shrill note of the red-headed woodpecker that of a species of tree frog which frequents the same trees. In the latter case the resemblance is so great that the cries can hardly be distinguished. The squirrel and the snake reproduce in their alarm-cries the sounds made by these animals during rapid retreat—the squirrel the swish of a long twig, and the snake the rustling of dry grass as she glides through it. He gives very numerous instances of birds imitating other birds.[1]

A few years ago Mr. W. E. D. Scott found that Baltimore orioles when left without training sing a song of their own. He reared two young birds of this species so that they did not hear any song or notes to imitate. Two years later he secured three other young orioles about six days old and placed them with the older ones. His conclusion is that "two birds *isolated from their own kind and from all birds*, but with a strong inherited tendency to sing, originated a novel method of song, and that four birds, *isolated from wild representatives of their own kind and associated with these two who had invented the new song*, learned it from them and never sang in any other way."

[1] *Cf.* Evolution of Bird Song.

The call notes of these birds was similar to that of the wild species.[1]

During a period of six or seven years he took many birds from their nests when very young, reared them by hand until they could take care of themselves, and then liberated them in large rooms in order to give them as much freedom as confinement would allow. In this way he tried to observe what birds would do if left to themselves and supplied with food and water. No effort was made, however, to keep these birds from hearing the song of wild birds out of doors. The following species were secured: 12 bluebirds, 14 robins, 6 woodthrushes, 7 catbirds, 2 thrashers, 2 yellow-breasted chats, 2 rose-breasted grosbeaks, 1 cardinal, 6 Baltimore orioles, 7 orchard orioles, 1 bobolink, 2 cowbirds, 4 crow-blackbirds, 5 red-winged blackbirds, 1 meadow lark, 6 bluejays. None of these birds had normal songs.[2]

In 1903 Scott reared a brood of bobolinks and two broods of red-winged blackbirds; the former were secured when about four days old and the latter when about a week old. There were two males in each species. The song of these four birds was such that competent judges did not recognize it as the song of the species. The two bobolinks had no note that resembles the call-note nor any sound that resembles the song of the wild species; the two red-winged blackbirds, however, had the call-note of their species. He also reared, in the same year, two male grosbeaks from their fourth day on. The tone of their song, he says, has the soft plaintive quality characteristic of the rose-breasted grosbeak, but the method is not that of the wild species.[3]

The call-note of birds seems to be, as a rule, more clearly subject to inheritance than song, being biologically much older. Witchell has found in this connection that the cries of the young of birds physically allied are more alike than the cries or songs of adults of the same species. He thinks that the original cries of the various kinds of birds are recorded in their danger-cries and call-notes, and that the notes of later developed cries and modes of singing are indicated in the first parts of songs because these have the most generic characters. As to the question of imitation in call-notes one can but agree with Witchell who says until extensive experiments have been made we shall not be able to determine the extent to which imitation generally affects the call-notes of the young. Furthermore, in experiments on this subject all contact with the parents must be avoided, since the note of the parent may have an effect on the bird

[1] *Science*, 1901, Vol. XIV.
[2] *Science*, 1902, Vol. XV.
[3] *Science*, 1904, Vol. XIX.

even before it is hatched. Scott thinks that it is improbable that during the first few days of their lives birds acquire much appreciation of the song of the male parent though he is constantly singing close at hand. That the notes of the parents, however, affect the young even before hatching is shown by the observations of W. H. Hudson who has observed several different species on this point. He says: "When the little prisoner is hammering at its shell, and uttering its feeble *peep*, as if begging to be let out, if the warning note is uttered, even at a considerable distance, the strokes and complaining instantly cease, and the chick will then remain quiescent in the shell for a long time, or until the parent, by a changed note, conveys to it an intimation that the danger is over.[1]

Though the last part of this statement does not seem to rest on a rigorously scientific basis, and the first part is not checked by experiment as to whether the unhatched bird would react to other noises than alarm-cries, yet the observation seems to show that the voice of the parent bird affects the young even before hatching.

Experiments indicating to what extent a bird that has no native song can be taught the song of another species, and to what extent the call-notes of one species may be imitated by another are few. With this question in mind the writer attempted to raise English sparrows in the nest of canaries. The English sparrow was selected not only because it is an unmusical bird, but also because it is a bird of unusual independence.

The earliest scientific record of an experiment to teach the English sparrow to sing is that by Daines Barrington as early as 1773. He says: "I took a common sparrow from the nest when it was fledged and educated him under a linnet; the bird, however, by accident heard a goldfinch also, and his song was, therefore, a mixture of the linnet and goldfinch," and adds, "though the scholar imitated the passages of its master, yet the tone of the sparrow had by no means the mellowness of the original. . . . The imitation might therefore be, in some measure, compared to the singing of an opera song by a blackguard."

Witchell says: "The male wild sparrow, when perched comfortably in sunshine, often rehearses his vocabulary in a way which indicates attempts at song. If reared under birds of another species in a cage, the sparrow has their notes, and not sparrow notes, though he retains the sparrow tone of voice, and he may then become quite a pleasing singer." He gives no concrete examples, however, and adds that though he has listened for years for a sign of mimicry, he has heard only one

[1] The Naturalist in La Plata, p. 90.

sparrow imitate, and that one reproduced the alarm-cry of the starling. His brother, E. N. Witchell, he says, has heard a sparrow imitating the alarm-cry of the blackbird and the whistle of the chaffinch. He says he has often heard the male sparrow give what seems to be a song note as follows: "teeoo-woh." He thinks it indicates contentment. It might be added here that it is a matter of common observation that the sparrow gives a succession of notes which can be interpreted as a crude attempt at song.

Sterland also reports the case of a sparrow that learned the song of the skylark. We here and there find other statements to the effect that the English sparrow will imitate the song of other birds, but they are not supported by new evidence and are probably based on the experiments above quoted. (Sterland's report I take from Witchell, Evolution of Bird Song.)

The plan of our experiment was to have the canary hatch the sparrow-eggs and rear the birds without hearing a sparrow note, so that every impression whatever that the parent sparrow's note might have on the young, even during the first moments of life, might be ruled out. The experiment was begun July 1, 1903. During the summer of 1903, however, little was accomplished since the canaries did not nest, the molting season being at hand, and when they nested in the fall the sparrows had stopped laying. One canary hatched a brood of sparrows but they all died from lack of care from their canary mother. The cause of this neglect is probably difficult to explain; it may be that the eggs hatched too soon since the sparrows had already brooded them to within 3½ days of hatching, or it may be that the female canary was discouraged because the male had been removed—the following year another female canary from whom the male had been separated neglected its brood of young sparrows. The next year, 1904, the experiment was continued as soon as the sparrows began to lay, which was about the middle of April, but without success. Nine attempts were made, but all failed. In one case the canary neglected her young; in three cases the canary deserted her nest, possibly because the time of hatching was somewhat extended due to the change of eggs from canary to sparrow; in two cases the canaries failed to nest and in two cases the females took sick. In one case the brood of four sparrows was duly hatched and well cared for by the parents, but on the 10th day the female canary went into the nest and with seeming malice stamped them to death. She was caught in the act but too late to save any of the young. I cannot give a satisfactory explanation of this vicious act. It is true, the sparrow at this age is more naked, and, to our sense of beauty, more ugly than the young canary, yet it is too much to suppose that the canary has the

same esthetic sense. However, it is possible that the canary's instincts were done violence in some way, since another sparrow, mentioned later in this paper, raised in a canary's nest grew up seriously crippled.

Another part of the experiment carried on at the same time was more successful. When my first and only brood of sparrows in 1903 were dying, I procured, on July 15, four other young sparrows about one day old and placed them in the canary nest just as the last one of the original brood was passing away. Of these four all but one died. This bird after he had been placed in the canary's nest heard no other sparrow chirp but his own. He grew up seemingly well. But when he was old enough to leave the nest I found that he had both feet crippled, that his tail came out sideways and that his wings were deficient. What happened to him is not known; it may be he received vicious treatment similar to that administered to the other brood mentioned above.

In due time this bird developed his sparrow chirp when calling for food, though he heard no sparrow note and was in a room with about twenty or more canaries, some of which were young and were just beginning to sing. By and by he gave this chirp less and less, using a fine peep instead—a peep similar to the peep of the young canaries. During September the sparrow chirp was rare and when it was given it lacked the harshness of that of the wild sparrow, but had a quality rather similar to that of the whistle of the quail. After Oct. 20, I observed the bird daily, but before that time I observed him only two or three times a week, long enough to hear him go through a characteristic chirping spell.[1] The bird was now observed daily not only by myself but also by my wife whose opportunities for observation were better than mine. He showed no tendency to imitate song till Oct. 29th, when he suddenly chimed in with the canaries in his own fashion, giving a low note followed by a few high notes with now and then some slurs from a high to a low note similar to the notes the canaries have in their overtures. He joined the canaries freely for a few days when he became ill and was silent for a few weeks. About the middle of November he again joined the canaries violently, but it was such a confusion of notes that I was not able to record them. In general outline his effort resembled the confusion of notes which occurred when all three of my canaries were singing their best. This violent, confused song which consists of a rapid repetition of single notes and which

[1] Up to this time the bird was kept with the canaries of Mrs. and Miss Harrington, 8 Norwood Street, Worcester, for whose kind assistance in this matter I wish to acknowledge my indebtedness.

was not very musical but rather harsh (the loudest of my canaries also has a harsh voice), he kept up till he was taken away from the canaries about May 1st, 1904. He kept up this song for some weeks after his removal, but by the middle of July had lost it completely. The causes are discussed in a later part of the paper.

About July 3, 1903, I got two sparrows probably about two weeks old. A few days later I got four little fledglings. I fed them by hand with rolled cracker and hard boiled egg mixed, to which I later added small bird seed. I placed them all near my canaries for instruction. The instruction, however, was very meagre, since before September only one of the male canaries sang occasionally and one female gave an occasional solitary, unmusical trill. Between Aug. 15–25th there was absolutely no canary song at all, but the canary call notes were given though not as freely as usual. After September 2 the canaries gradually began to sing again. Thus we see that the sparrows' instruction was extremely moderate during the first two months and rather inadequate during the third month of their life. That is, during probably the most impressionable age of the birds' life the instruction was most seriously insufficient.

Since it is often hard to accustom wild birds to cage life a few words as to feeding may not be out of order. During the latter part of August the sparrows showed signs of being sick, probably because I tried to feed them chiefly with cracked grain. I now again gave them a variety of seeds and kept fresh sand in the cage as before; I gave them again egg and cracker as I had done when they were young, but I noticed no improvement till I gave them fish bone. This they ate greedily for a while, and one of this group got well, the others all died. The two birds that I still have I am feeding with a variety of small bird seeds, also cracked sunflower seed, hempseed and grain, whole wheat bread, crackers (without salt), fishbone, greens—daily in summer, and now and then rolled cracker mixed with grated hard boiled egg. They eat very little, if any, grain, and my experience leads me to believe that seeds and special bone material are indispensable for these birds. They have been perfectly healthy since their first sick spell.

All the sparrows of this second group had their sparrow chirp well developed when I got them, and the one that remained alive is the only one of this group that ever attempted to imitate the canaries; he always showed more vitality than the others. During the first part of August, when the canary sang, he would sometimes give notes that were different from the regular sparrow chirp; they were less forcible, lower and hoarser. Even when he uttered no sounds throat movements

were often noticed when the canary was singing. Toward the latter part of the month these notes became louder so that they could be heard distinctly in an adjoining room. They always were given only when the canary sang though the sparrow chirp was given freely at any time. He now began to give notes in rapid succession running up the scale from three to five notes and then giving five to six of the higher notes all in one run. He gave three or four such runs in rapid succession, each containing about from eight to twelve notes. In the latter part of September he was observed to run up and down and up the scale all in one run.

At first his voice was not beautiful; it was hoarse. It sounded somewhat like the voice of some female canaries when they try to sing. Some notes remind one of the human voice when one recovers from a cold. He sang on a lower scale; he often tried to reach higher notes but did not succeed. Later his voice became softer and milder and approached in quality the voice of the canary.

On September 26, when the sparrow was a little over three months old, he was for the first time observed to give a trill. It was short and musical and was given a number of times in succession. These short trills were at first only rare but they increased in frequency during the year. When he gave them he would sit still on his perch and give them one after another very modestly. Now (Dec., 1904) he gives short trills interspersed with other notes, punctuating the whole by turning complete circles and semi-circles on his perch.

None of these sparrows ever had the characteristic call-notes of the wild species, but by and by adopted those of the canary. They imitated the canary perfectly except that their voice did not have the musical finish. The bird that was two weeks old when I got him gave the *shikikik* alarm-cry occasionally at first, but later lost it altogether.

About May 1, 1904, I took both sparrows to a room in the university away from the canaries. For the first few weeks they maintained themselves very well in their new quarters. They were here, however, not only deprived of the instruction and the stimlus which the canaries gave them, but they were literally flooded with sparrow notes from the outside, so that by the middle of July they had not only lost their song, but had readopted a considerable part of the sparrow chirp. Their voice remained more musical than that of the sparrow, but the pitch and general flow of the chirp resembled that of the wild sparrow. About the middle of September I placed the canaries and the sparrows together again and in a few weeks they regained completely what they had lost.

Here we have, then, two young sparrows which in about nine

months not only imitated some of the song of the canary but also adopted the canary's call-note, and which upon removal from the canaries and again hearing sparrow notes very freely, rather rapidly dropped back into the ways of the sparrow, but upon renewed instruction rapidly regained all they had lost.

It is intended to continue this experiment by hatching and rearing sparrows in the nest of the canary, and, if possible, to raise sparrows by hatching the eggs in an incubator and rearing them by hand without allowing them to hear a sparrow or any other bird note. Raising a bird by another species and having it imitate the notes of that species can demonstrate the power of education; if a bird can be reared without hearing any bird notes whatever more light may be obtained on the question of instinct.

Bibliography.

Barrington, Daines. Experiments and Observations on the Singing of Birds. *Philosophical Transactions*, London, 1773, Vol. LXIII, part 1, pp. 249-291.

Hudson, W. H. The Naturalist in La Plata. London, 1895, pp. 394. (Third ed., chap. on birds.)

Morgan, Lloyd. Habit and Instinct. New York, 1896, pp. 352.

Scott, W. E. D. Data on Song in Birds. *Science*, 1901, Vol. XIV, pp. 522-526; Vol. XV, pp. 178-181; Vol. XIX (1904), pp. 154, 957-959; Vol. XX (1904), pp. 282, 283.

Witchell, C. A. The Evolution of Bird Song, with Observations on the Influence of Heredity and Imitation. London, 1896, pp. 253.

—— Cries and Call-notes of Wild Birds. London, 1899, pp. 84.

STUDIES FROM THE PSYCHOLOGICAL LABORATORY OF THE UNIVERSITY OF MICHIGAN.

COMMUNICATED BY W. B. PILLSBURY.

IX. EYE-MOVEMENTS.

BY BERNICE BARNES.

Comparatively little work has been done on the subject of eye-movements, although its psychological value has been much disputed.

Two important laws of movement have been formulated, the law of preference of the primary position, or Listing's Law, and the law of constant orientation, known as Donder's Law. These laws are variously stated. Helmholtz[1] phrases Donder's Law thus: "Given the position of the line of regard in relation to the head, and you have given with it a definite and invariable torsion value." Meinong[2] expresses it in the same way. Wundt says, "The orientation of the eye for any position of the line of vision is constant, no matter by what path the line of vision may have been brought to this position." That is to say, if you set out with the lines of regard parallel, you may move from any position you like, to any other position you like in the field of regard, and the orientation of the eye in this second position will always be the same, whether the eye is moved directly from the first position to the second, or in the most roundabout way.

Listing's Law implies not only a parallel position of the lines of regard, but also the primary position of the eyes as a starting-point. Helmholtz says: "If the line of regard travel from the primary to any other position, the torsion of the eyeball in the second position is the same as if the eye had turned about a fixed axis at right angles to the first and second directions of the line of regard. Hering states it more clearly and Meinong uses about the same words: "In movements from the primary position, the line of vision can describe a plane path, or the regard travel along a straight line, in any direction whatever, without there being any torsion of the eye at all about the line

[1] Physiologische Optik, p. 619.

[2] Ueber Raddrehung, Rollung u. Aberration, Zeitschrift für Psychologie and Physiologie, Vol. XVII, pp. 161 ff.

of vision," in other words, the eye can be turned in all directions about a fixed axis, at right angles to the line of vision, without causing torsion about the line of vision. Wundt's[1] statement is somewhat more complicated, "All movements from the primary position take place around fixed axes, each of which cuts the plane described by the line of vision in turning, at right angles in the point of rotation, and all of which lie in a single plane, cutting the primary position of the line of vision at right angles in the point of rotation." That is to say, if you set out with the lines of regard parallel in the primary position, you may move to any point of the field of regard that you like, in the vertical, horizontal or oblique direction, and your eye will undergo no torsion at all.

As to the psychological value of these laws, Helmholtz looks upon Donder's Law as a guarantee that resting objects in the field of vision are recognized as such, when the eye itself has been moved. Hering estimates Listing's Law thus, "It brings the space perception (localization) of the moved eye into the greatest possible unison with the localizations of the resting eyes, so that the displacements of the mental images harmonize with the intended movements of regard, while it also assures in far vision the most perfect possible correspondence of the retinal images of the double eye."

So much for the statement and significance of these laws. A word of explanation is necessary regarding the terms used. All movements of the eye may be conceived as rotations about one or more of three axes, a sagittal axis, corresponding with the line of sight, which passes directly through the centre of the pupil from front to back; a frontal axis, extending horizontally from left to right, and a vertical axis. Theoretically, all these intersect at right angles in the centre of rotation of the eye. What is known as the primary position, is the position which the eyes assume when the head and body are erect, and the eyes are directed forward to a distant horizon. Any other position is called a secondary position, although Helmholtz often speaks of a tertiary position, in movements from one secondary position to another. The point on which the eyes are fixed when in the primary position is the primary fixation-point, or principle point of regard. The field of vision is the extent of space that can be seen with the eye at rest. The field of regard is the extent of space that can be seen when the eyes are moved.

The method used by Helmholtz and others for determining the validity of the laws of Donders and Listing, and other facts of eye-movement, is the so-called after-image method. A strip

[1] Wundt: Grundzüge d. Phys. Psycho., II, p. 525.

or a cross of red or green paper is put in the centre of a sheet of gray cardboard, which is tacked on a wall space, preferably of neutral gray like the cardboard, although white will do, at such a height that the eyes of the subject, seated at a table some feet distant, may, in the primary position, be fixated on the red paper. Several points are then chosen on the wall about the cardboard, and the distances carefully measured. The eye is then turned from the primary position to these various points, and of course the after-image of the colored slip appears at the point, turned or straight as the case may be, and the amount of turning is measured. This method of experimentation is very crude, for after-images are unstable and illusory things, the best you can make of them, and the results are of necessity very inaccurate, since the person carrying on the experiment holds a slip of paper the size of the red slip, at the point to which the eyes are directed and turns the slip until the subject says that it coincides with the after-image which he sees there. It is evident that the slightest movement of the eyes in this new position will cause considerable shifting of the after-image.

In my experiment I have used a more complicated and elaborate instrument, which insures accurate results. This instrument may be called a torsio-meter, since its main object is to measure the amount of torsion, or rotation about the sagittal axis, which takes place when the eye is moved from one position to another. It consists of an iron arc of 180°, one meter in diameter, mounted on a standard, so that its centre may be directly in front of the eye of the subject, who is seated before it. This arc may be raised or lowered a number of degrees, according to the height of the subject, and the results desired. It may also be swung around from the horizontal to any oblique position or to a vertical position. On this arc is screwed a small, adjustable telescope, having a fine spider web across the eye-piece, which, together with its setting, may be rotated. The amount of rotation is measured by an indicator on a small arc surrounding the telescope, and divided into 50° positive and 50° negative, that is, rotation to the right is measured in negative degrees, since the subject faces the instrument, and rotation toward the left in positive degrees. The large arc on which the telescope is placed is also divided off into degrees. Suppose, now, that the subject is seated in front of the arc, with his head securely adjusted in a head-rest to prevent head movements. A thread is stretched across from end to end of the arc, and the exact centre marked with ink. The ink spot is placed directly in front of the pupil of the eye, and the thread may then be dropped so as to prevent any hindrance from it during the taking of results. The telescope is adjusted at the

middle of the arc, at the zero point, and focused directly on the eye. The experimenter then looks through the telescope, which magnifies sufficiently so that the tiny lines radiating from the pupil through the iris may be clearly distinguished. The eye-piece is now turned so that the spider web rests directly on one of these lines, and then the point shown by the indicator on the arc of the telescope is taken. The results will be less complicated if a distinct line can be covered with the horsehair at the zero-point. I succeeded in doing this with both of my subjects. Then the telescope is moved several degrees to the right or left on the large arc; the eyes move toward the same point, and the lens is turned so that the hair rests on the same line which was chosen at the zero-point. The number of degrees which the indicator moves during this process, will, of course, be the number of degrees of torsion which has taken place during the movement of the eye from one position to the other. Care should be taken that the lines of regard be always parallel, that is, that the eyes should be fixed on an infinitely distant point.

My results differ in some respects from those which have been gained by others, and in other respects they agree. Helmholtz says, "When the movement takes place from the primary position, simple raising or lowering of the eyes without deviation to the side, or simple side movements without raising or sinking, results in no torsion." With the after-image method, this was found to be the case, since the results are only approximate, and the subject is scarcely able to cognize slight deviations from the horizontal or perpendicular, at the distance he is obliged to sit from the wall. With the more accurate instrument, however, the torsion in each case was decidedly noticeable, though slight. (See Table II 1 and 2.) He says further, "In raising or lowering to the same points, the rotation is the more marked, the greater the deviation to the side, and in side movements to the same points, the torsion is more marked the greater the raising or lowering." With this statement my results agree very well. (See Table II.)

In some respects I get the same results as Meinong. For instance, he says, quoting from the two laws of movement, " 'In movements from the primary position no torsion takes place. In movements from secondary positions torsion does take place.' These two laws are found to be contradictory. For example: let the eye travel from the primary position diagonally upward to a point at the right of a fixation point at some distance directly above the primary. Another time let it travel from the primary position vertically up to the height of this fixation point, and then horizontally to the right until the above given point is reached. According to the first of the

laws quoted above, the eye, if it moves from the primary position, reaches its goal without torsion as well with a vertical as with a diagonal movement." As a matter of fact, it is found, that torsion, and, moreover, the same amount of torsion, takes place in the diagonal movement as in the vertical and horizontal movements, since the eye is in exactly the same position when the given point is reached, no matter how it has moved to get there. Table IV. (See Donder's Law. Also Table II 11.) The two laws, when taken together, may be reduced to absurdity, since if no torsion took place in turning from the primary to the secondary position, the eye would be in the same position at the secondary point, so far as torsion is concerned, as at the primary point, so that movements from the secondary point would have the same effect as movements from the original primary. Hence no torsion would exist at all. Meinong says, in conclusion to the statement above quoted, "In that secondary position commonly called third position (reached by diagonal movement or vertical + horizontal), the horizontal meridian remains no longer horizontal, the original vertical meridian not vertical, the two positions being twisted in the same manner around the line of vision as axis, so that to such movements, torsion cannot well be denied." Meinong used the after-image method in arriving at this result; but, as I said above, I reached the same conclusion by means of the more accurate instrument, being able by it to measure the exact amount of turning of both movements. (See Table II 11.)

Graefe[1] says, "In raising the line of vision up to the left and sinking the same down to the right, the vertical meridian is inclined toward the left." I find that my results substantiate this also (see Table II 3, 4, 5, 6, 7 and 8.), and would add that in raising the line of vision up to the right and sinking it down to the left, torsion toward the right occurs; in sinking it down to the right and raising it up toward the left, torsion takes place toward the right, and in sinking it down to the left and raising it up to the right, torsion takes place toward the left.

Helmholtz says, "In raised position of the plane of vision, side movements toward the right produce torsion toward the left, and side movements toward the left, torsion toward the right. In a lowered position of the plane of vision, side movements to the right produce also torsion toward the right, and *vice versa*." This also I found to be correct. (See Tables III and IV 9 and 10.)

If I were to sum up my results in a general law of eye move-

[1] v. Graefe u. Saemisch, Handbuch der Augenheilkunde, Vol. VI.

ment, I should state it thus: "Every movement of the eyes, whether from the primary position to a secondary position, or from a secondary position to any other, is always accompanied by a definite amount of torsion, varying according to the scope of the movement.

Any inaccuracy of results is due to one of two causes. It is impossible to avoid slight movements of the head even when a head-rest is used. The other cause of inaccuracy is what Meinong calls "false torsion," meaning by that, that the eye may turn about the sagittal axis when at rest in the primary position. If it can do this, then the same kind of rotation can take place during movements, or at the second fixation point before the record can be taken, thus detracting from the accuracy of results supposed to be gained by the effect of movement alone. The experiment is very fatiguing, both to the subject and to the experimenter, and frequent intervals of rest are necessary.

I. After-image Method.

It must be remembered that these results are only approximate, and that suggestion plays a great rôle, inasmuch as after the subject says that he sees the image in a certain place once, he will always see it there.

3. Diagonal Movements.

	Up to rt.				Down to rt.				Up to lft.				Down to lft.			
	50 cm.		1 m.		50 cm.		1 m.		50 cm.		1 m.		50 cm.		1 m.	
Turning.	K.	U.	K.	U.	K.	U.	K.	U.	K.	U.	K.	U.	K.	U.	K.	U.
Average.	−5°	−5°	−10°	−6°	−3°	5°	0	−6°	10°	−5°	−5°	1.4°	5°	5°	7°	5.6°
Mean Var.	0	0	0	2°	2°	0	3°	1°	0	0	0	3°	0	0	1°	1.4°

The negative sign denotes that the image is turned down, toward the left, the positive that it is turned up, toward the right. (These results are not corrected for false torsion, due to projection on a plane surface. W. B. P.)

II. Torsion-metre Method.

The positive sign indicates torsion toward the left, and the negative sign torsion toward the right, since the subject necessarily sits facing the instrument.

My subjects in both methods are Miss Killen and Miss Udell.

This table needs little comment. It will be seen that there

is always torsion. That the amount of torsion is always approximately the same for the two subjects and for symmetrical positions. The mean variation is always small, within the limits of error for the instrument. It will be noticed also that there is a progressive increase in torsion with the increase in rotation, and more in the diagonal than in either the horizontal or vertical directions.

TABLE II.

Distance turned.	5°		10°		15°		20°		25°		30°	
Subject.	K	U	K	U	K	U	K	U	K	U	K	U
Direction of turn'g.												
Hor. rt.	-1.2	-1.8	-3.0	-3.0	-4.0	-5	-7.4	-7.6	-9.4	-10.0	-12.0	-11.8
m. v.	.2	.2	0.4	0.4	0.4	0.0	0.6	0.2	0.4	0.4	0.4	0.2
Hor. left.	1.6	1.6	3.4	2.8	5.2	5.2	7.6	7.8	9.8	10.2	12.2	12.0
m. v.	.2	.2	0.2	0.2	0.4	0.2	0.6	0.4	0.2	0.4	0.4	0.4
Ver. up.	1.6	1.6	3.0	3.0	5.0	5.6	7.6	8.0	9.6	10.4	11.8	12.4
m. v.	0.2	0.2	0.4	0.4	0.4	0.2	0.4	0.4	0.2	0.2	0.4	0.2
Ver. dwn.	-1.4	-1.8	-3.0	-3.0	-5.2	-4.8	-7.2	-7.8	-9.6	-9.8	-12.0	-11.8
m. v.	0.2	0.2	0.4	0.4	0.2	0.2	0.6	0.2	0.6	0.2	0.4	0.2
30° up.	-2.4	-2.8	-4.0	-4.0	-6.0	-6.6	-8.2	-9.0	-10.6	-11.4	-13.0	-13.4
m. v.	0.2	0.2	0.4	0.4	0.0	0.2	0.6	0.4	0.6	0.2	0.4	0.2
30° dwn.	2.6	2.8	4.0	4.2	6.0	5.8	8.6	8.8	10.6	10.8	12.8	12.8
m. v.	0.2	0.2	0.4	0.2	0.4	0.2	0.6	0.2	0.2	0.2	0.4	0.2
-30° up.	2.6	2.6	4.2	3.8	6.4	6.2	8.6	8.6	10.8	11.2	13.2	13.2
m. v.	0.2	0.2	0.2	0.4	0.2	0.2	0.4	0.6	0.4	0.4	0.2	0.4
-30° dwn.	-2.8	-2.6	-4.0	-4.4	-5.8	-6.0	-8.8	-8.6	-10.8	-10.6	-12.8	-12.6
m. v.	0.2	0.2	0.4	0.2	0.4	0	0.4	0.4	0.2	0.2	0.2	0.4
40° up.	-3.6	-3.6	-5.2	-5.4	-7.4	-7.0	-9.6	-9.6	-11.8	-11.6	-14.2	-13.6
m. v.	0.2	0.2	0.2	0.2	0.2	0.0	0.4	0.4	0.6	0.2	0.2	0.4
40° dwn.	3.8	3.6	5.0	4.8	6.8	7.2	9.6	9.6	11.8	12.2	13.8	14.2
m. v.	0.2	0.2	0.4	0.4	0.4	0.2	0.6	0.6	0.2	0.4	0.2	0.4
-40° up.	3.4	4.0	5.0	5.6	6.8	7.2	8.8	10.4	11.8	12.2	13.8	14.2
m. v.	0.2	0.0	0.4	0.2	0.2	0.4	0.4	0.2	0.2	0.4	0.4	0.2
-40° dwn.	-3.6	-3.8	-5.4	-5.2	-7.4	-7.0	-9.2	-10.0	-12.0	-11.4	-12.2	-13.8
m. v.	0.2	0.2	0.2	0.2	0.2	0.0	0.4	0.4	0.4	0.4	0.4	0.2
50° up.	-4.4	-4.8	-6.0	-6.2	-7.8	-8.0	-9.8	-11.0	-12.8	-12.4	-14.8	-14.8
m. v.	0.2	0.2	0.4	0.2	0.2	0.0	0.4	0.4	0.2	0.4	0.4	0.2
50° dwn.	4.4	5.0	5.4	5.6	8.4	8.2	10.2	11.4	13.0	13.2	15.2	15.2
m. v.	0.2	0.0	0.2	0.2	0.2	0.4	0.4	0.2	0.4	0.4	0.4	0.2
-50° up.	4.6	4.8	6.0	6.0	8.2	8.4	10.6	11.0	12.6	13.6	15.0	15.4
m. v.	0.2	0.2	0.4	0.4	0.4	0.2	0.6	0.4	0.2	0.2	0.4	0.2
-50° dwn.	-4.6	-4.6	-6.0	-6.2	-7.8	-8.0	-10°	-10.8	-12.4	-12.8	-15.0	-14.6
m. v.	0.2	0.2	0.4	0.2	0.2	0.0	0.6	0.2	0.4	0.2	0.4	0.2

It might be suspected that we had not secured exactly the plane of the primary position and that torsion was due to that fact. To disarm this criticism a set of experiments was made with the fixation point raised 10 cm. about 11° above the position previously used and another with the fixation point lowered the same amount. Table III shows that each position gave a greater torsion than the one chosen as primary. The vertical deviation from the primary position was then small.

TABLE III.

Horizontal rotation with plane of sight raised and lowered 11°.

		5°		10°		15°		20°		25°		30°	
		K.	U.	K.	U.	K.	U.	K.	U.	K.	U.	K.	U.
Arc raised 11°.	Right.	-2.6	-2.0	-4.4	-3.6	-6.2	-6.4	-8.4	-8.8	-10.8	-11.2	-13.4	-13.0
		0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.4	0.6	0.4	0.2	0.4
	Left.	2.8	2.6	3.8	4.4	6.0	5.8	8.6	8.8	10.8	10.6	13.0	12.6
		0.2	0.2	0.2	0.2	0.4	0.2	0.6	0.2	0.2	0.2	0.4	0.2
Arc low'rd 11°.	Right.	-2.8	-2.6	-4.2	-3.8	-6.0	-6.0	-8.4	-8.6	-10.2	-10.8	-13.2	-13.2
		0.2	0.2	0.2	0.4	0.4	0.4	0.6	0.2	0.2	0.2	0.2	0.4
	Left.	2.6	2.4	4.0	4.4	6.6	6.2	8.6	8.8	11.0	10.6	13.0	13.2
		0.2	0.2	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.4	0.2

The next question that we had to answer was to determine the validity of Donder's law. We did this by measuring the amount of torsion when the same diagonal position had been reached directly from the primary position, and by a combination of horizontal and vertical movements. In each case the result of the diagonal movement was taken first, and immediately followed by the result of the vertical and horizontal movement. In nearly every instance the results coincide exactly as will be seen from the Table. Donder's Law seems to hold. There is not the slightest evidence for Listing's Law.

11. Movements to same point by diagonal and by horizontal and vertical. From 10 cm. below primary position.

(a) Diagonal	5°		10°		15°		20°		25°		30°	
	K.	U.	K.	U.	K.	U.	K.	U.	K.	U.	K.	U.
Average.	4.0°	4.0°	5.8°	5.8°	7.8°	7.4°	10.0°	10.0°	12.0	12.2°	14.6°	14.2°
Mean Var.	.4°	.0	.2°	.4°	.2°	.2°	.6°	.6°	.40	.4°	.2°	.4°

11. Movements to same point, etc.—Continued.

(b) Hor. & Ver.												
Average.	4.0°	4.0°	5.6°	5.8°	7.8°	7.2°	10.0°	10.0°	12.6°	12.2°	14.6°	14.4°
Mean Var.	.4°	0	.2°	.4°	.2°	.2°	.6°	.6°	.2°	.4°	.2°	.4°

SUMMARY.

1. It is evident that there is a contradiction between Listing's and Donder's laws for torsion in eye movement.

2. Experiments by the after-image method seemed to confirm Listing's law. But there are two sources of error—inaccuracies in measurement, and false torsion, due to projection on a plane surface, which it is difficult to make allowances for.

3. More accurate direct measurements show that there is always torsion with rotation, and the amount of torsion is proportional to the amount of rotation.

4. Donder's law holds. The eye has the same amount of torsion in each position whether that position be reached by direct movemement from the primary position or by two successive movements.

THE PROBLEMS OF EXPERIMENTAL PSYCHOLOGY.[1]

By E. B. TITCHENER.

The first difficulty that confronts one, as one attempts to envisage the problems of experimental psychology, is the difficulty of definition. What is a psychological experiment? What is the scope of experimental psychology? Is experiment simply a method of work, applicable to all or to some special parts of the psychological system; or is experimental psychology a distinct branch of psychology, sharply marked off from other and coordinate branches?

The programme of this Congress would seem to have decided the issue in the latter sense; for we find sections of general psychology, of comparative and genetic psychology, of abnormal psychology and of social psychology, arranged alongside of our own section of experimental psychology. If, then, I wished to take shelter behind the plan of the programme, I might, with some show of justification, confine myself to the discussion of those problems in normal, human, adult psychology which still form the staple material of experimental investigation in the laboratories, and might omit all reference to the extensions of the experimental method to outlying fields. Such a course would, nevertheless, be unsatisfactory. The extensions of the method are coming to play a larger and larger part in psychological discussions and in our psychological literature; and it behoves us to take up a stand with regard to them, positive or negative, appreciative or critical. I shall try not to shirk this duty. Let me say, however, at the outset—and I shall have more to say upon the matter presently—that, whatever else experimental psychology may be, there can be no doubt that the subjects to which the programme apparently limits us are experimental psychology. The examination, under strictly controlled and properly varied conditions, of the normal, adult, human mind—this is psychological experiment in its pure, primary and typical form. And it is this typical experimental psychology the problems of which we have, in the first place, to consider.

In approaching this question of the problems of experimental

[1]Address delivered at the International Congress of Arts and Science, St. Louis, September, 1904.

psychology, it seemed to me that the surest key to the future lay in the accomplishment of the past. The best way to find out what experimental psychology has to do is, I thought, to make certain of what it has already done. With this idea in mind, I naturally had recourse to our bibliographies,—the American bibliography of the *Psychological Review*, and the German of the *Zeitschrift f. Psychologie*. The result was not encouraging. We all knew, of course, that the plan of arrangement of these two yearly lists is by no means the same. What I, for one, had not realised was the fact that the plan of arrangement of both is eminently unsystematic. We use a bibliography and find it useful; we do not need to enquire further regarding it. But I do not believe that any psychologist, of whatever school, could write a systematic psychology on the lines laid down in these bibliographies. This fact—if fact it is—seems worthy of a passing remark; for it indicates, in a concrete and definite way, that in spite of the enormous increase of our psychological knowledge, within the last few decades, we are still very far from any complete or rounded science of psychology. I am not so much disposed to blame the bibliographers—I take their lack of system to be unavoidable—as I am to draw a long breath at the amount of work which still remains for us to do.

Finding that I could not avail myself of the bibliographies, I took the bull by the horns, and went to the psychological journals. I listed and analysed the experimental papers in the *Philosophische Studien*, the *Zeitschrift f. Psychologie*, the *Année psychologique*, the *American Journal of Psychology* and the *Psychological Review;* not with any view of substituting a classification of my own for the classifications now employed, but simply with the intention of finding out what was there. If you object that these five journals are not coextensive with experimental psychology, I must reply that they are at any rate representative, and that the duration of human life is limited. Even so, I am not sure that the game was worth the candle. I earned, perhaps, by hard work, the right to stand upon this platform; but I found out very little that I did not know before.

If I am to indicate, briefly, the results of this enquiry, I must premise that we are agreed upon the distinction, within experimental psychology, between the properly 'psychological' and the psychophysical attitudes. The object of the 'psychological' experiment, as I am now using the phrase, is introspective acquaintance with the processes and formations of a given consciouness. The object of the psychophysical experiment, as we have recently been reminded by G. E. Müller,—I suppose that we are all fresh from a reading of his 'Psychophysische Methodik,'—is a numerical determination. Thus, the object of the simple reaction, regarded as a psychological experiment,

is the introspective analysis of the action consciousness, given under certain fixed conditions; the object of the same experiment, regarded psychophysically, is the ascertainment of a representative time-value and of the manner and limits of its variation. Both points of view are covered by the general term 'experimental psychology'; both types of experiment are valuable; but the two must not be confused. If, now, we look at the contents of the *Philosophische Studien*, the oldest established of our five journals, we find that three departments of experimental investigation are preferred high above the rest: sensation, perception and action. There is, moreover, a very definite trend towards psychophysics, so that, *e. g.*, at least two fifths of the articles that deal with sensation must be classed outright as psychophysical. The remaining experimental papers may be subsumed under the headings: association of ideas, attention, feeling, memory and recognition, the organic accompaniments of the mental life, the range of consciousness, the processes involved in the activities of reading and writing, and the time consciousness. What we find in the other four journals is a continuance of interest in these same problems, but a continuance of interest which is combined with a shift of emphasis from psychophysics to psychology, and a widening of the area of experimental work. Thus in the *Studien* there are about twice as many articles on sensation, psychological and psychophysical, as there are on perception; in the *American Journal*, the articles on perception are more numerous than those on sensation; in the *Psychological Reveiw* there are, roughly, three articles on perception for every two on sensation, while the strictly psychophysical papers may almost be counted upon the fingers of one hand: and the *Année psychologique*, if I have counted aright, has practically as many articles on memory as it has on perception, and more of either than it has on sensation, while the spirit of the work has, from the first, been adverse to psychophysics. Or again, the contents of the *American Journal* may, with some manipulation, be brought under the same headings that served for the *Studien*, save that one additional caption must be made for studies of voluntary movement (other than reactions) and of the experiences of effort and fatigue; while those of the *Zeitschrift* and the *Psychological Review* require at any rate three or four new rubrics, to cover work done upon mental inhibitions, the process of learning, motor automatisms and motor dispositions, habit, etc. I do not wish to labor this point, even if I must leave it with some sense of injustice to the periodicals under review. You know, without my telling you, and I knew, without going to the magazines, that the course of experimental psychology in recent years has been away from simple psychophysical determinations, and towards introspective analysis; and that the

experimental method has been continually extended from the simpler processes to the more complex,—whether to complexes hitherto untouched by experiment, or to unfamiliar phases of familiar mental formations. All that a study of the journals can do is to quantify and define these facts. I should like to add, however, that their study has brought home to me, in a very vivid way, the immense complexity and far-reaching interconnection of the mental life. The contents of experimental papers are oftentimes so varied that only a classification *a potiori* is possible; and, oftentimes again, results that are but incidental to the given topic of investigation prove later on to be fundamental for problems from which this topic had seemed disconnected and remote.

So much, then, by way of preparation. Let us now, in the light of it, attempt to formulate the present problems of experimental psychology. You will remember that I am speaking of experimental psychology *sensu stricto*,—of the experimental investigation of the normal, adult, human consciousness. I wish that I could proceed systematically. But, in the existing condition of the science, it is better to be topical. We may, however, begin in a quasi-systematic way, by considering the three fundamental problems of sensation, affection and attention.

(1) *Sensation.*—The senses, viewed from the standpoint of psychological knowledge, fall into three principal groups. We know a great deal about sight and hearing; we know a good deal about taste, smell and the cutaneous senses; of the organic sensations, with a very few exceptions, we know practically nothing. There is work to be done—I say this emphatically—in every field; there is probably no single chapter in sense psychology that may not, with advantage, be reopened. Nevertheless, we know a great deal about sight and hearing; the literature of these senses is voluminous; advance in our knowledge lies (I am speaking in the large and quite roughly) in the hands of the few experts who have occupied themselves particularly with visual and auditory problems. And we know a good deal about taste, smell and the cutaneous senses; although here, doubtless, there is much steady work, rank and file work, yet to be done. We know something of the organic complex concerned in active touch, and something of the static sense. On the other hand, of the organic sensations in general we know practically nothing. Here then, as I take it, lies the immediate sense problem for experimental psychology. When we remember the importance of organic sensation in the affective life, its importance as the vehicle of sensory judgments in psychophysical work, the part it plays in the mechanism of memory and recognition or in the motives

to action, its importance for the primary perception of self; when we remember the wide-spread character of the organic reaction set up by any sensory stimulus; when we realise that some psychological systems have recourse to it from beginning to end, while others (Wundt's recent 'Grundzüge' is an example) practically ignore it; when we remember that certain questions of prime systematic importance hinge upon it,—the question of the duality of the conscious elements, of the relative range of sensation and image, of what is called affective memory, and so on: we can hardly fail to see that here is a great gap in our psychological knowledge, the filling of which calls for a persistent application of the experimental method. Of all problems in the psychology of sense that are now before us, the problem of the number, nature and laws of connection of the organic sensations appears to me to be the most pressing.

In the domain of psychophysics, I see no single problem of supreme import, but rather a need for patient, continuous work by the methods already formulated. The inherent aim of psychophysical investigation is, as I have said, the determination of the psychophysical constants. Now it is by no means difficult to vary a psychophysical method, and so to set up a claim of originality; but it requires patience and some self-sacrifice to work through a psychophysical method to the bitter end. What we now want is less ingenuity and more work,—accurate, continuous work all along the line. We have methods and we have formulæ. Let us give them a thorough test. The results will be of extreme value for psychophysics, and no one need fear that they will be barren for psychology. On the contrary, no small part of our analytical knowledge of the higher processes, as they are called,—processes of judgment, of comparison, of abstraction,—derives straight from the method-work of psychophysics. It would, in my opinion, be time and energy well spent, if every existing laboratory were to undertake what one might term the routine work of testing out, without modification, one or other of the classical methods.

I am aware that psychophysics trenches upon large problems. I ought, indeed, to be keenly alive to these problems, seeing that for the past three years they have occupied me, with but little intermission. There is the great problem of mental measurement itself; there are the minor problems of the validity of the difference limen, the equality of just noticeable differences, the range of Weber's Law, the correlation of functional constants, and what not. If I were speaking of the history of experimental psychology, and not of its present status, I might hope to show you that more has been done towards a solution of these problems than the current state-

ments in text-books and magazines would lead one to suppose. But, with these problems in mind, I insist that the immediate demand in psychophysics is for careful, straightforward work by the approved methods. We shall gain more from such work than from anything else.

(2) *Affection.*—When we turn to the affective processes, we have no such difficulty in selecting our problems. This whole chapter in experimental psychology is one single problem. Will you believe—I had myself not realised it before—that in all the five and thirty volumes of the *Zeitschrift* there is not a solitary experimental article on the feelings? This although the same volumes contain, roughly, two hundred contributions to experimental psychology! The *Studien* has about one hundred and forty experimental papers, of which nine deal with affective psychology or experimental æsthetics: that is the best record I have found. Now look at the problems. We are not at one as regards the nature and number of the elementary affections; there are experimental psychologists who reduce all the elements of consciousness to sensations. We are not agreed whether the diversity of feelings is to be referred to a diversity of affective process proper or to a diversity of organic sensation. Some of us think that a given affective process is coextensive with consciousness; others maintain that consciousness may be a mosaic of affections. Some assert that the feeling element is effective for association; others deny it this effectiveness. Some find the best illustrations of the law of contrast in the sphere of feeling; to others, contrast may itself be a feeling. Our facts are few, our laws dubious. Surely, it is time to gird up our loins, and make serious business of these affective problems.

I have insisted on the paucity of the experimental articles upon feeling. I do not, by this, mean to accuse experimental psychology of idleness or neglect: Lehmann's two books would save us from such a charge, if we had nothing else to offer. But these two books are characterised by their reliance upon the expressive method,—a method which, as you are aware, has stood in the forefront of many recent discussions. I have been at the pains to make out a complete table—complete, that is, so far as I was able to make it complete—of the results obtained by the method of expression. There is much to be learned from them. But I can not believe that the method will help us very greatly towards an affective psychology. The organic reactions which the expressive method registers are closely interwoven and interdependent, and the task of differentiation presents difficulties which, if not insurmountable, have at least not yet been surmounted. I am disposed to think, *e. g.*, that the plethysmograph, as a differential instrument, is

doomed to disappear from our laboratories. The sphygmograph, and especially the pneumograph hold out better hope; but I doubt if, at the best, a differentiation of affective qualities is to be expected from them. From the method of suggestion, which really takes us over into social psychology, I expect still less. There remains, at present, only the method of impression, which has done good service in a limited field, and which should be capable of modification and expansion. However, I am fortunately not called upon here to propose methods of work, but only to indicate problems. And the facts and laws of the affective life, the life of feeling and emotion, form one of the largest and one of the most insistent problems of modern experimental psychology.

(3) *Attention.*—The prominence given to the state of attention is characteristic of experimental psychology, as contrasted with the empirical psychology of associationism. It is, indeed, one of Wundt's greatest services to the new psychology that he early divined the cardinal importance of attention in the psychological system, and began that series of experiments of which we can by no means see the end to-day. For I imagine that we must all admit, if we are honest with ourselves, that the body of facts at our disposal, large and varied as it is, is yet not adequate to a theory of the attentive state. We must know more of the constitution of the attentive consciousness, and of the mechanism of distraction; much remains to be done before we cn settle the vexed questions of the distribution of attention; we must work out, experimentally, the relation of attention to affective process; even the familiar problems of the range and duration of the attentive state are—well! are still problems. I am not sure that we shall not have to manifold the study of attention, as we have that of memory; and to speak in future of the facts and laws of visual attention, auditory attention, and so on, instead of taking 'attention' as a single state. I am certain that we must have a more specialised psychology of the great variants and resultants of attention,—a specialised psychology of expectation and habituation, of practice and fatigue.

If, then, I have seized the situation correctly, we have in these three fundamental departments of psychology three problems of different orders, the solution of which calls for a diverse endowment of psychological skill and insight. There is an outlying group of sensations that can, we must believe, be successfully attacked by the analytic methods which have been successfully employed in the other sense departments. The experimental study of the affective processes calls for a much greater gift of originality and constructive imagination; we have to shake off literature and tradition, and to begin al-

most at the beginning. In the case of attention, we have to push on and make progress along paths already marked out, but insufficiently explored.

What holds in this regard of the attention seems to me to hold also (4) for that mixed medley of formations which we include under the general term *perception*. I wish that we could banish the word 'perception' to the special limbo reserved for unregenerate concepts, and could put in its place a round dozen of concrete and descriptive terms! But it has, so far, held its own, and I can hardly avoid its use. We know, now, a great deal about tonal fusion, about space perceptions, about rhythm —if rhythm be a perception; we know something about time perception. You will, however, agree with me that no one of these topics is a closed chapter. I see no very pressing problem, as I look over the field; but I see, in every quarter of it, good work that needs doing. I am sorry if this opinion appears indefinite; it is the opinion that I have come to after a study of more than a hundred and fifty articles that deal with perception in the five journals referred to just now: and I can not make it more definite without going so deeply into detail as far to exceed the time allotted to me.

We can speak a little more concretely of (5) *recognition*, *memory* and *association*. Association was, at first, handled in rather stepmotherly fashion by experimental psychology. Of late years, however, we have come to see the importance of detailed analysis of the associative, as also of the recognitive consciousness; we have, I think, finally broken free from the traditional schemata, and are approaching the problem with open minds. Something has already been done; much more remains to do. The experimental study of memory was begun, by Ebbinghaus, rather in a practical or psychophysical than in a psychological spirit. In the development of the work since Ebbinghaus, we can trace two tendencies: a tendency towards psychological analysis of the memory consciousness and the explication of the psychological laws of memory: that on the one hand: and on the other, a tendency towards the application in practice of psychological results. While, now, I take the recent experimental work on memory and the associations involved in memory to be work of a high order: and while I believe, in particular, that certain of the methods employed are a valuable addition to our psychological repertory; I can not but think that the two tendencies just mentioned have not been kept as distinct as they should have been, and that experimental psychology has suffered in consequence. We can hardly hope to get a psychology of memory and association on the ground of Reproduktionstendenz and Perseverationstendenz: we can hardly hope to get practical rules, if they

are what we want, out of the published studies on economy of learning. The Tendenz-concepts are psychophysical, and tend to cover up the complexity of actual experience; the practical studies are made under conditions widely remote from those that obtain in ordinary practice. Let us realise that we may attempt here any one of three distinct problems. We may aim at a psychology of memory and association; *i. e.*, we may seek to record our experience, to trace the introspective patterning of the memory consciousness. We may aim at a psychophysics of memory; *i. e.*, we may try to establish formulæ akin to the well-known formula of Ebbinghaus' 'Gedächtnis,' which represents retention as a function of time elapsed. Or we may aim at an applied psychology of memory; we may work out, experimentally, an art of acquisition. I do not say that an investigation into one of these three topics will throw no light on the other two: on the contrary, I have already insisted on the value of indirect results in psychological enquiries. But in our thought, at any rate, the three problems should remain separate and distinct. They offer, without doubt, a wide field for future research. I would suggest, though with all reserve, that the psychological study of memory and association may, in the long run, help us to clear up the much disputed question of the subconscious. There are, as you know, experimental psychologists who work simply in terms of introspection and of physiological process; there are others who interpolate between these terms an unconscious or subconscious mentality. I can not go into detail; but it seems to me that, if these differences of opinion can in any connection be brought into the laboratory for adjustment, it is here, in the investigation of memory and association, that we may hope to introduce them.

I come next (6) to *action*. You will remember that, in its early years, experimental psychology was much concerned with the psychophysics of action; indeed, the problem of the 'personal equation' is a good deal older than our laboratories. This interest has never flagged. If we have not heard so much of late about reaction experiments, we have heard a great deal about the psychophysiology and psychophysics of voluntary movement. And I think that we can leave these things to take care of themselves; we may, without any question, look to the next few years for improvements of technique, for revision of numerical determinations, for recasting of theories. That work is under way. What I should like now to emphasise is the need for investigation of the more strictly psychological kind. Our knowledge of the action consciousness is still very schematic, very rough, in part very hypothetical. It has been recognised for some years that the reaction experi-

ment may be turned to qualitative, *i. e.*, to analytical account; but so far more use has been made of this idea in laboratory practice than in research. We must start all over again, and take the action consciousness seriously. I once made a sort of reaction experiment of the setting-up and taking-down of an inductorium; the student made the manipulations continuously, under time control, and gave his introspective record at the end of each experiment. We worked at the problem for a year, only to learn that we had been too ambitious; we had, as even with experience one is apt to do, underestimated the complexity of consciousness. At the same time, we decided that the problem was soluble; we gathered in a good store of introspective results, even if they were too individual, and too discrete, to be employed for generalisation; with more time and more observers, or with a simpler set of voluntary movements for study, we should have accomplished something for psychology. I regard such studies as those recently made on the control of the retrahens of the ear, or on the control of the winking reflex, as extremely promising in this field. At any rate, whether we work from the classical reaction experiment, or whether we take voluntary movement under more natural conditions, the problem is quite definite: we must submit action to an introspective analysis as detailed and as searching as that to which we have subjected perception.

I have put off (7) *imagination*, because I am a little afraid of the term. It is a word which, like perception, I should be glad to see discarded from the vocabulary of experimental psychology. I think that we employ it more vaguely even than we employ perception; and I think that the future will substitute for it a number of descriptive terms. If we begin with the elementary process, the image itself, we must plead ignorance on two fundamental points: whether image quality is coextensive with sensation quality, and whether image difference is adequate to sense discrimination. If we go to the other extreme, and regard imagination as the general name for a group of typical formations,—as a concept coordinate with memory,—we must surely say that experimental psychology is, as yet, hardly over the threshold of the subject. We know, perhaps, how to set to work: some investigations have been made, and some hints toward method have been given; but, in the large, this chapter of experimental psychology remains to be written.

(8) Of the more complex *affective* formations we can say but little until we have a better psychology of feeling. No doubt, there are certain problems in the psychology of sentiment, and more especially in that of the æsthetic sentiments, that can, within limits, be handled without regard to the ulti-

mate categories of feeling. I should, however, consider these limits as very strictly drawn. (9) For the higher *intellectual* processes we have, I think, three sources of knowledge: direct experiment,—that, as you know, has been well begun,—the indirect results of experiment upon sensation, and Völkerpsychologie. I am inclined to lay great stress upon the second of these sources. Experimental psychology has often been reproached, on the one hand, because it devotes most of its time to sensation, and on the other because the results of its dealings with the higher processes are jejune and meagre. To the former charge I plead guilty, in so far as we have avoided the affective problems, though this neglect is not at all what the framers of the accusation have in mind. And even so, I might offer in extenuation the experimental work upon attention. But this apart, I think that experimental psychology is justified in its choice of topics. The only way to catch the higher intellectual processes in course of formation is to work from the periphery, by way of the sense organs. It is when we are working with tones, or with lifted weights, that the amazing diversity and complexity of judgment becomes apparent. If, on the contrary, we take any one of these higher processes full-formed, and attack it directly, we are very likely to find that the vehicle of the mental function is extremely simple; there is a law of reduction, running all through mind, whereby a highly complex formation tends to degenerate, to reduce to a stereotyped simplicity. It is, to my mind, a distinct merit of experimental psychology that it has brought to light this meagreness of content in the examination of 'higher' mental functions of an habitual order; and it is a healthy instinct that sends us back and back again to the channels of sense, as we seek an appreciation of the fulness and richness of the mental life. I may add, though I say this a little hesitatingly, as a merely personal impression, that the introspective attitude of the observer seems to me to be more nearly normal, less artificial, in cases where the avowed object of experimentation is comparatively simple. If you are asked overtly to grapple with a complex psychosis, you are likely to brace yourself to the task, to put on an armor of preconceived opinion; if the psychosis meets you unawares, finds you off guard, the facts will have their own way with you. A distinguished English psychologist once declared that it is futile to attempt the problems of recognition by way of rotating discs of black and white sectors. I should say, on the contrary, that these discs are, in principle, the very best means to an understanding of the higher intellectual formations.

As for the ultimate goal of experimental endeavor, I suppose that we may call it (10) the problem of *consciousness*,—

not in the sense in which that problem is understood by the theorist of knowledge, but in this sense: that, as hitherto we have analysed and traced to their conditions certain mental processes, of lesser or higher degrees of complication, so now we analyse and trace to their conditions total consciousnesses, given in varying states and constituted of various formations. The difficulty of this problem is enormous. Only those of you who have attempted it, in one case or other, for yourselves; who have discarded classificatory terms, and faced the living facts; only these, even of experimental psychologists by profession and training, can form any proper idea of its difficulty. It is a problem for which we are not yet ripe. We can approach it only by way of theories which we know to be inadequate, and by help of hypotheses which we can not substantiate by facts. But it is the problem towards which we are trending, and the road to its solution lies, as in my jndgment all such roads in our science lie, not through brilliant suggestion and ingenious forecast, but through patient and steady work. This work must be in part the work of experimental psychology, as we are here interpreting that phrase; in part the work of what is called individual psychology,—though, indeed, from perception onwards, the difference between these two departments of psychological investigation is simply a difference of accent. Or, to put the matter concretely, we must work not only with the doctrine of states of consciousness, comparing experimentally the attentive and the inattentive, the hypnotic and the dreaming, all sorts of normal and abnormal states of consciousness, but also with the doctrine of conscious types which we owe (and the debt is great) to the psychologists of individual variation.

So I finish the first part of my review. If I have omitted anything of consequence, or if I have seemed to do injustice to any department of work, I must ask for pardon and correction; I have spoken with the utmost possible brevity. My own habitual thought in experimental psychology is positive, not negative; that is, I am accustomed to look upon our problems rather as continuations of work already begun than as gaps and lacunæ in our system of knowledge. I could wish that it had fallen to my lot to address you in this positive way, to show what experimental psychology has done, how in the past few decades it has changed the face of systematic psychology, rather than to insist upon the tasks that still lie before it. I have, however, tried to be entirely honest; I have, I think, rather exaggerated than concealed our deficiencies; and I would have you remember that this definite formulation of things to do presupposes and implies that much has been done. When Wundt wrote his famous essay 'Ueber die Aufgaben der

experimentellen Psychologie,' the problems that loomed before him were the psychophysics of sensation, the analysis of perception, the time-relations of the higher processes. To-day, the list is longer and the range wider. But it is only because we already possess that we can say, in such detail, what still needs to be added to our possessions: in which fact let us take encouragement.

I pass, with some diffidence, to a consideration of wider issues,—of those extensions of the experimental method, proposed or attempted, of which I spoke at the beginning of this address. Most psychologists, I take it, would agree that the picture I have drawn of experimental psychology in what has preceded is drawn too narrowly. The title of psychologist is, indeed, given at the present day to two distinct types of scholar. On the one hand, we have the psychologist as I have represented him: a man keenly interested in mind, with no purpose beyond mind; a man enamored of introspection; a man to whom the most fascinating thing in the universe is the human consciousness; a man to whom successful analysis of an unresolved mental complex is as the discovery of a new genus to the zoölogist or a new river to the explorer; a man who lives in direct companionship with his mental processes as the naturalist lives with the creatures that are ordinarily shunned or ignored; a man to whom the facts and laws of mind are, if I may so put it, the most real things that the world can show. On the other hand, we have men to whom mind appeals either as a datum or problem, or both, to be dealt with by philosophy, by theory of knowledge and theory of being; or as a natural phenomenon, something that must be taken account of whenever life is taken account of, in evolutionary biology, in anthropology, in medicine, and where not. Of the psychologists of this second order, the philosophers, you will say, do not concern us. Yet they do, somewhat. I suppose that all sciences—certainly, all young sciences—are liable to be told by well-wishers that they have mistaken their work; that they would advance more quickly, and more solidly, if they would put off their present business, and settle down to this or that suggested problem. At any rate, experimental psychology has always received such hortation from friendly philosophers. If, now, I have ignored this advice, it is not from lack of gratitude, but simply because, after consideration, I have come to believe that experimental psychology knows what she is about, and can walk without assistance. Outsiders, we are told, see most of the game. I venture to urge that the insider better knows how the game is to be played.

We are left with the two opposed types: what shall I term

them?—the inner and the outer, the subjective and the objective, the narrower and the broader. What, then, of the outer, wider, objective problems of experimental psychology?

Let us be clear, first of all—the matter admits of no hesitation or compromise—that the experimental psychology of the normal, adult, human mind must take the form that I have described,—the form of introspective analysis. I have little sympathy or patience with those experimentalists who would build up an experimental psychology out of psychophysics and logic: who throw stimuli into the organism, take reactions out, and then, from some change in the nature of the reactions, *infer* the fact of a change in consciousness. Why in the world should one argue and infer, when consciousness itself is there, always there, waiting to be interrogated? This is but a penny-in-the-slot sort of science. Compared with introspective psychology, it is quick, it is easy, it is often showy. We have been a little bit corrupted by the early interest in psychophysics; or perhaps, more truly, we have not all learned instinctively to distinguish between psychophysics and psychology proper, and so we are apt to take the tables and curves of reactions for psychological results, and the inferences from them for psychological laws. Now the results, where they are not purely physiological or anthropometrical, are psychophysical results. As such, they have their usefulness; and the psychological laboratory is their right place of origin. But there is no reason why one should gain psychological credit for them—still less for erecting a speculative psychology upon their foundation. This mode of psychologising is inherently as vicious as any of the constructive modes of the older psychology, the psychology before experiment. Historically, it has proved disastrous;[1] it falsifies problems and obscures real issues; we must set our faces against it now and for all time. How, indeed, shall we call a man a psychologist who deliberately turns his back upon the one psychological method, in the one field to which that method directly applies? There is no excuse in psychology, for the neglect of introspection, save the one—and that must be demonstrated—that introspection is impossible.

Having said this much by way of preface, I may take up the further question. We can hardly open a magazine nowadays without finding applications of the experimental method beyond the limits of the normal, adult, human mind. In animal psychology, in child psychology, in various departments of mental pathology, the experimental method is employed. Even the conservative *Studien* contains articles on the state of

[1] Is proof needed? Think of the early work upon the just noticeable difference, upon the simple reaction, upon the 'time sense'; or think of Wundt's current discussion of Weber's and Merkel's laws!

sleep and dreaming, and Wundt has looked more favorably upon experiments under hypnosis since they promise to confirm his theory of feeling. Experiments on children and animals have for some years past occupied the attention of leading American psychologists; work on child psychology is characteristic of the *Année psychologique*, and is being published more and more freely by the *Zeitschrift;* you all know the avowed purpose of Kraepelin's 'Arbeiten.' I need not multiply references. Wherever psychological interest has gone, in these fields, the experimental method has gone with it. Sometimes the particular experiment is borrowed forthright from the normal practice of the laboratory, sometimes the procedure has been recast to suit the novel problem; sometimes the experimental method is taken seriously, employed with care and knowledge, sometimes it is thrown in as a makeweight, without responsibility or understanding; sometimes it is praised, sometimes decried. All this is natural. The important thing for us is, I think, the recognition that the experiments are a part of 'experimental psychology,' in the sense of this paper, and must be taken account of in any general review of the problems of experimental psychology. The psychologist of the laboratory is apt to emphasise the crudity and roughness of the work, and its neglect of introspective control; the psychologist of the clinic or the schoolroom or the animal room is apt to consider his colleague narrow and his colleague's work finical and meticulous. The transcending of this difference, the reconciliation of these views, I take to be a very real problem for experimental psychology—though a problem of a different order from those that I have been discussing. And I suggest the following points for your consideration. First, that one can not be too nice or too careful in experimenting on mind. There is no such thing as over-refinement of method.[1] Let those who doubt this fact read Martin and Müller's 'Unterschiedsempfindlichkeit'; the more delicately one analyses, the more subtle does mental process reveal itself to be. Galton's questionary results on visualisation are psychology, and valuable psychology; but they are also pioneer psychology. Now, the pioneer may pride himself on his work, but not on the roughness of his work. When the laboratory psychologist smiles at the charcoal sketches of objective experiment—well! he does wrong to smile, because honest work should not be laughed at; but he is right in his conviction that the details are all to come, and that the simplification of the lines means overhasty generalisation. Mind is, so to say, our com-

[1] A method may be too refined for the man who is using it, or for the problem upon which he is immediately engaged. But these are different matters.

mon enemy; and the laboratory psychologist learns, by dearly bought experience, not to underestimate his opponent. Secondly, I would remind you that, after all, objective work in psychology must always be inferential; introspection gives the pattern, sets the standard of analysis and explanation. If we interpret the animal mind by the law of parsimony, our only justification is that introspection discovers the reign of this law in the human consciousness; if we subsume the evolution of mind in the animal series to the principle of natural selection, our only justification is, again, that introspection discovers the working of this same principle in our own case. As I put it just now, there is but one excuse for the neglect of introspection in psychology, and that is that introspection is impossible; but even here our neglect is methodical only, and does not—must not—extend to interpretation. These things have been said so often[1] that they have become commonplaces; but even a commonplace may be true,—and it makes a difference, too, whether the truth be urged with polemical or with friendly intent. I should like to see more coöperation between the alienist, or the student of comparative psychology, and the laboratory psychologist; quite apart from practical results, such coöperation would be of great advantage to the psychological system. We can hardly hope—this point should be borne in mind—that the two interests, the objective and the subjective, will be combined in the same person. When one has once stepped inside the ring of the normal, adult consciousness, there is very little temptation to step out again; the problems that I listed a little while ago are enough to occupy several generations of workers, and the fascination of the work is like the fascination of the mountains or the sea. And if one begins from the outside, with the child or the animal or the abnormal mind, there is little likelihood that one can breathe the confining air of the laboratory, or that one will presently limit one's range of interests to oneself. Partly it is a matter of temperament, partly a matter of chance introduction or of continued occupation. The two types of psychologist are distinct; all the more reason that they should work in harmonious coöperation.

I hope that, in this latter portion of my address, I have not traveled too far out of the record. Some men have problems thrust upon them. And, after all, if what I have said contributes ever so little to the furtherance of mutual aid and the

[1] In saying them, from the 'narrower' point of view, I am, of course, hoping for similar cautions (at any rate, for varied advice and information) from the more 'objective' psychologists. What they will have to tell their colleagues of the laboratory, I do not know; but I have no doubt that it will be worth listening to.

increase of mutual esteem, as between psychologists of different camps, I may hope for forgiveness, even though I have exceeded the letter of my instructions. Now let me briefly summarise what I have said. I began, you will remember, by pointing out that, above and apart from the many special problems of experimental psychology, there lies the great problem of self-definition, of the range and scope of the experimental method in psychology. Then, under the headings of psychology proper and of psychophysics, I called your attention to a series of laboratory problems that, more or less insistently, more or less immediately, call for solution. Whatever else experimental psychology may be, I said, these issues are issues of experimental psychology. Incidentally, I deprecated any departure, at the bidding of philosophy, from the straight path of psychological investigation; and I deprecated also that neglect of introspective control in psychology which has been the besetting sin of many whose direct interest lies in psychophysics. I then went on to include in experimental psychology the more objective applications of the experimental method in child psychology, in animal psychology, in abnormal psychology. It was not my province to detail the special questions in these fields; they form the topic of other addresses in other sections. But I should regard as incomplete any review of the problems of experimental psychology which omitted reference to them. Their consideration helps us to attack that first problem of definition, clarifies our method, and furnishes an opportunity for the give-and-take of criticism and encouragement. We can not afford to misunderstand one another, as we can not afford to waste our time on unreal and constructive problems. The work presses; the rule of work is definite and unmistakable; there is room in the workshop for all sorts and conditions of men. I do not think that the outlook of any science could be more hopeful; I do not think that we need fear a lessening of that quiet enthusiasm which, from the first, in the beginner as in the mature student, has been the salient characteristic of the experimental psychologist.

EXPERIMENTAL PSYCHOLOGY IN ITALY.

By PROFESSOR G. C. FERRARI,
Director of the Emilian Medico-Pedagogical Institute, Bertaglia, Bologna.

Reading with a real interest the title of the article of Dr. Chiabra, "The Tendencies of Experimental Psychology in Italy," published in the October number of the *American Journal of Psychology*, I was very greatly surprised when I perused the few pages in which the author treats his subject. And, although it is always in bad taste for compatriots to contradict each other before strangers, I believe it my duty as an Italian to present to the readers of the *American Journal of Psychology*, rightly so well thought of for the exactness of its information, some facts, which will, I think, modify the opinion which my countryman has had the honor to express concerning experimental psychology in Italy and its tendencies.

Mr. Chiabra has every reason to praise unreservedly the work of two such eminent persons as Professor Mosso and Professor De Sarlo, although the first marks no other than himself and is particularly the representative of his own strong personality, and the second does not belong altogether, by his work, to the Leipzig school. But he is very wrong in speaking of a subject, about which he is not fully informed, when he ignores many others in Italy, who, without following in anybody's steps, have sought to open wide for psychology the way of experiment.

I shall limit myself to a simple enumeration, to show that, even if Italy has been the last to reach this field, it has already taken in it a considerable place.

With us the beginnings of experimental psychology have been very precocious and very important. Every conscientious experimenter in the field of physiological psychology knows the researches made by Gabriele Buccola in the Psychiatrical Institute of Reggio Emilia, and published by him in 1888, in a volume entitled "La legge del tempo nei fenomeni del pensiero." Now, Buccola was, without doubt, the first to make use of lunatics for the study of the problems of normal psychology. This, as tendency, has its value, and as he was the first, the honor is one at which Italians should rejoice. The premature death of Buccola did not prevent the work of two of his friends, Guicciardi and Tanzi, whose researches in the fields of psychopathology and physiological psychology

are, doubtless, known to Mr. Chiabra. From that time the Psychiatric Institute of Reggio Emilia has always kept the tradition of experimental psychology (it was there that in 1890-1891, De Sarlo made his first mark with an important experimental study on cerebral circulation under diverse conditions) and there, in 1896, through the initiative of Professor Tamburini, was established the first Laboratory of Experimental Psychology, properly so-called, in Italy.[1]

In this laboratory during 1896-1902, I worked with Guicciardi, Bernardini and many others, being the first to introduce into Italy "mental tests," which I applied first to lunatics and afterwards to all exceptional cases which I happened to come across. It is curious that Mr. Chiabra takes no notice of this.

It is the same Psychiatric Institute of Reggio Emilia, which publishes the *Rivista Sperimentale di Freniatria*. This journal has published almost all the psychological contributions of Italian workers, not only those connected with the Institute itself (as De Sarlo), but those at other centres of research, Morselli, especially, Colucci, De Sanctis, Patrizi (of the University of Modena, a pupil of Mosso and a psychologist of the first order), who has given to experimental psychology a number of very important instruments, *e. g.*, those by which he was able to demonstrate vasomotor mancinism, the crural ergograph apparatus, etc.

Nor can one understand at all the silence of Mr. Chiabra concerning the recent foundation of two chairs of experimental psychology, one at the University of Rome, occupied by Professor De Sanctis, the other at the University of Naples, occupied by Professor Colucci. This was a very important step taken by our government in recognizing the right of existence of experimental psychology, and it is indeed strange, that an educated man, as Mr. Chiabra shows himself to be, does not know the works of De Sanctis on dreams, on abnormal childhood, on attention, on intellectual imitation, or those of Colucci on ergography, on reform schools, on the psychology of dements, and his curious experiments on the ventricles of the brain.

I cannot speak here of all the workers who have from time to time made valuable contributions to experimental psychology.[2] I have desired to limit myself expressly to those who,

[1]Professor Sergi had already at this time a Laboratory of Anthropology and Psychology at Rome. The description may be read in Delabarre's article on "Laboratoires de Psychologie," in the first volume of Binèt's *Année Psychologique*.

[2]The works of Pizzoli on pedagogic psychology and the means of studying it,—very ingenious means, described by him in Nos. 2-3, of Vol. XXX, of the *Rivista Sperimentale di Freniatria*, deserve special mention, but I can make here only a simple *erratum compendum*.

by the *ensemble* of their works, represent a "tendency," and for that reason deserve to be mentioned in an article entitled "The Tendencies of Experimental Psychology in Italy."

On this point, I wish to remark further. In Italy, according to Mr. Chiabra, experimental psychology follows two tendencies, that of Münsterberg and that of Wundt. The members who will go to the International Psychological Congress at Rome, in 1905, will plainly see that the question is one of simple affirmation.

I could not say whether there are reasons of ethnic psychology to explain the fact, or whether it is merely a matter of mental habits, but it is very true, nevertheless, that, although he accepts what is useful and good in all philosophies, and in all orders of thought, the Italian always and in all cases, retains much of his psychological individuality,—from outside he accepts ordinarily only the initial stimulus.

Of this we have before our eyes to-day a luminous example (although Mr. Chiabra has not yet noted it) in the enormous impulse given to psychology here by my translation of the "Principles of Psychology" of the great American psychologist, William James. This translation dates from 1901 and in two years the first edition of more than 2,000 copies has been exhausted! For a country on the road to fortune, but still very poor, such a success, expected (I boldly confess it) by no one except myself, has something marvellous about it. Naturally this influence is very broad and more noticeable, perhaps, in the world of philosophy, than in that of psychology. I believe, however, that this publication marked a turning point in the history of Italian psychology.

In order to co-ordinate the general work now being done in Italy, I intend to publish in January, 1905, a special journal entitled *Rivista di Psicologia applicata alla Pedagogia ed alla Psicopatologia*. It is a great pity that very important experimental contributions are buried (as often happens) in specialist journals, where nobody hunts them out. If the new journal shall be permitted to centralize the work of all Italian psychologists, there will be seen springing naturally from the mass, diverse tendencies reflecting the special individuality of our thinkers and at the same time affirming the independence and originality of their thought.

PROOF AND DISPROOF OF CORRELATION.

By C. SPEARMAN.

In the last October number of this *Journal* an article by G. Whipple several times did me the honour of mentioning some work which had appeared there earlier in the year. Unfortunately, however, he does not appear to correctly realized the principles enunciated ; as others may be in the like case and as the principles are believed to be of some importance, perhaps a few words may be allowed here in explanation and example.

For instance, in opposing the correlation alleged by Gilbert[1] between 'brightness' and 'reaction-time,' Whipple asks: "What evidence have we that the reactions are correlated with mental ability? When we are told that 'bright' children react more quickly than 'dull,' we find that the quantitative support is afforded by the figures 207, 213 and 224 for the three groups (bright, average and dull, respectively). How much are we within the limits of certainty?"[2] Now, on pages 78-87 of this *Journal*, several methods will be found of calculating the information desired. Or on p. 280 the answer will be found already worked out, showing the amount of correlation in this case to be 0.19 ± 0.94; this means that the influence of the common factor as compared with those not common is as 0.19^2 to $1-0.19^2$, or as 3.6 to 96.4 (see p. 273); moreover, the correlation being nearly five times as large as the probable error, this correlation, though so small, has a certainty of about 1,000 to 1 (see p. 76).

"Again, Whipple argues that reaction-times cannot really be correlated with 'brightness' to any appreciable extent, because under strict conditions of test the reaction-times of all persons of the same type (that is, sensorial or muscular) are very nearly equal. Waiving the question of fact, even the principle cannot be admitted; correlation does not depend upon the greatness but upon the constant direction of deviations. For instance, the sharpest eyes cannot detect the tiny changes daily taking place in a bottle of mercury; yet these changes, though so minute, are all the time in almost perfect correlation with the temperature—and may be made to serve as a very delicate measure of it, on pouring the mercury into a thin, graduated tube. Had Gilbert's reaction-times been taken under very strict conditions of test, the correlation, instead of disap-

[1] Studies from Yale Psych. Lab., Vol. II. [2] Page 495.

pearing, as Whipple concludes, might have become much higher."

Further, he quotes the work of Wissler[1] as conclusively demonstrating that "the marking of A's, the naming of colors, the execution of rapid movements and the recording of simple association fail to show any significant correlation with one another."[2] Whipple recognizes that the tests in question were much too few and hurried to give at all truly representative results, but he considers this defect to be made good by the exhaustiveness and other merits of these experimental series; as the correlation turned out to be about nil time after time without exception, the general negative results may, he thinks, be accepted with confidence. This is, again, fundamentally erroneous; a series of irregular results, however excellent otherwise, can never disprove correlation; there is nothing to show that correlation does not really exist and has only been attenuated away to nothing by the irregularities; and if this occurs in one experimental series, it will punctually reoccur in every other series where the results are equally irregular (see pp. 89, 91 and 92).

On the other hand, he treats alleged "roughness" in some experiments of my own much more severely, as he argues that it vitiates the obtained correlations.[3] But I must point out that, though roughness or irregularity may perfectly well be cited to invalidate negative results as in Wissler's case, it can never be urged against positive ones as in my case; mere irregularity always *reduces* correlations, never conjures up illusive ones. Positive correlations can only be shaken by showing that the probable error is not much less than the correlation itself or that both terms are strongly influenced by some irrelevant *constant* factor; thus, the correlation found between intelligence and sensory acuteness would really be explained away if it could be shown that the variations in both were merely due to differences of intellectual maturity. Instead of the alleged roughness disproving the truth of the correlations, the highness of the correlations conclusively disproves the alleged roughness. Fortunately, Whipple has carefully mentioned wherein this roughness consists; he infers that the following points have been disregarded: moderate and equal intensity of sound, preliminary 'warming up' and favorable time-interval between the compared stimuli.[4] But how he came to conceive that these points were disregarded I cannot conceive; they would scarcely be neglected by a junior student; I am afraid that he must have omitted to peruse pages 243–47, where

[1] Psych. Rev. Monograph Supplement, June, 1901.
[2] Page 496. [3] Page 496–97. [4] Page 497.

account is given of the special precautions taken to secure all these desirable conditions. He also considers it improbable that proper attention was paid to the influence of practice; he would appear to have overlooked the six full pages devoted solely to describing the quite unusually elaborate researches and precautions taking to obviate disturbance from this cause. Most of all he emphasizes, as a disturbing factor discovered by himself, the fact that the power of discrimination may in exceptional cases vary enormously with the kind of timbre; but this fact had already been announced and discussed in my own work.[1] As far as I can see, the real grounds of his want of confidence are that the reagents were children and the tests did not take place in a laboratory. He will, therefore, be glad to hear that the experiments have since been repeated upon adult students of psychology and in an irreproachable laboratory; that upon this occasion I had the advantage of a co-worker so deservedly well known in acoustical psychology as Dr. F. Krueger; and that our results qualitative and quantitative were precisely similar to those previously published.

Before concluding, I should like to emphatically disclaim ever having recommended the test of pitch-discrimination (or anything else!) "as a universal and ready means for the estimation of General Intelligence" of any person; all I did was to point out that mathematical examination papers had shown themselves scarcely more reliable. I must also protest that he estimates too low the general deductions from the correlations when he sums these up in the harmless identity that "General Intelligence is General Intelligence." The correlations show that something which may be called General Intelligence *exists;* that all Specific Intelligences (within the range of these experiments) deal with intellectual ranges of vanishingly small dimensions; that the relative influences of the General and the Specific Intelligences respectively may be measured with great accuracy[2]. These facts are a germ which may eventually develop into immense practical reforms and, possibly, a theoretical revolution. On the other hand, Whipple appears to me to estimate too highly the current information concerning the real nature of this General Intelligence; he treats it as a simple matter requiring no further consideration. To me, at any rate, it is by no means so conveniently obvious, and Whipple's popular explanation appears, I am afraid, lacking in depth;

[1] Page 239.

[2] This is no estimate of the Intelligence of any person but only the first step in that direction—an estimate of any proposed *test* of Intelligence.

far from starting with a clear definition of General Intelligence, I had to content myself with using the term as denoting an almost unknown X "implying nothing more than a bare unequivocal indication of the factual conditions of the experiment."[1] To solve this X I proposed, and have since been gradually carrying out, a long investigation upon strictly experimental lines; the results up to now do not corroborate the popular assumptions.

[1] Page 250.

THE SIGNIFICANCE OF THE HUMAN HAND IN THE EVOLUTION OF MIND.

By ROBERT MACDOUGALL, New York University.

The human hand has long been an object of curious inquiry in connection with the study of character. The individual differences which it presents are many and striking. They affect the elements of color, venation, texture of skin, plumpness, size and general shapeliness. Variations in these factors give rise to a series of recognizable types which are popularly connected with special aptitudes and intellectual temperaments. Shapely hands, having a fine skin and tapering fingers, are the mark of an artistic nature; the broad hand, with firmly knit palm and short fingers, is characteristic of the man of affairs; the large-knuckled hand, with fingers set well apart and spatulous tipped, is the sign-manual of inventiveness and the philosophical bent. So close is the relation to human character and destiny which the conformation of the hand is supposed to bear that, like the shape of the head and the course of the stars in heaven, the interpretation of its signs has been made the subject of a so-called science and affords support to a numerous professional class.

The structure of the hand is complex and every feature is marked by well-defined and persistent peculiarities. The corrugations of the skin, constantly in process of destruction through the sloughing of the epidermis, are ceaselessly renewed in the very pattern and image of the original. The coarse-grained hand cannot be refined by any nicety of care, and that which is delicately moulded, though its shapeliness may be marred by the effects of heavy toil, bears to the end the hall-mark of its original beauty. The individuality of the hand, though more rarely noticed and studied, is no less characteristic than that of the human face; and like the latter possesses the capacity to preserve from generation to generation the traits which constitute family likenesses. Cavil as we may at the fine-drawn similitudes which have been made between the special features of the hand and the spiritual characteristics of its owner, and turn with disgust from the charlatanry which pretends to read in the palm a prediction of human fortune and fate, we nevertheless cannot escape the belief that there is still an intimate connection between the features of the hand and the soul of man.

It is indeed but an instance of the general connection between the two parallel systems which we call bodily and mental, the specific correspondences of which are being established from day to day in our experience, and thus gives us knowledge of other human minds. To maintain such a significance in the form of the hand, therefore, is simply to assert the persistence of its characters in the individual, and their stability in heredity. The whole bodily system presents the same relations; our interest, however, lies not in broad differences which separate us from other organic types and characteristics which are common to the human race as a whole, but in the special variations of individuals which give to each his personal qualities and capacities.

For the bodily signs of these mental traits and conditions we look primarily to posture, action and other expressive changes. The correlation is between certain physical activities and mental states which we know directly only in our own consciousness. The diagnosis is thus made upon the basis of functional, not structural, characteristics. The conception of systematic co-ordination between mind and body is carried much farther when we include the permanent features of the body, as well as the reactions in which passion and purpose are expressed, as part of the physical index of the individual mind. Yet this we constantly do in greater or smaller measure. The ugliness of Socrates may not appear to us the paradox which it was to the Greeks, but we do, nevertheless, adopt an analogous point of view in our judgments, namely, that character is not only expressed in special acts, but also correlated with particular anatomical features. Either an ultimate connection exists which cannot be reduced to simpler terms, or the habitual activity which expresses a prevailing mental trait moulds the features, the posture and the disposition of the body as a whole to sympathetic forms, which even in the absence of any specific reaction we interpret in subjective terms.

Any individual stamp which the impressions and activities of a single life can thus impose upon the body is necessarily limited to its minor features and relations. Certain professional habits, unhealthy modes of life, and occupations which subject those who follow them to deforming or poisonous agents have well-defined diatheses which we read without hesitation. But these changes are practically confined to the muscular and fatty tissues and to dermal alterations due to interferences with the digestive and eliminative processes. The larger anatomical features of the body and its general external qualities remain practically unaffected by the fortunes of the individual, and reappear unchanged in his offspring.

But there is another point of view from which the whole

question of the significance of specific bodily features and organs in relation to the mental life may be regarded, namely, as the condition of mental development in the species. The body cannot be conceived as an organ of mind in any sense which separates the fortunes of the two, and makes of the mind an independent entity, as the user of an instrument is commonly independent, in nature and origin, of the implement which he employs. The mind can be called the instrument of the body as logically as the body that of the mind. The Aristotelian formulation is unsurpassable as a statement of their empirical relations. The mind is the system of functions connected with the body, regarded subjectively. It is not given as a determinate reality apart from the body, which is later brought into connection with the latter as a medium of expression. The mind is the mind of that particularly bodily type with which it is correlated; for the character and range of its experience are essentially related to the sensory and reactive mechanisms of the physical organism. The body is the mind's limiting and determining condition as well as its "agent;" and both the quality of its constituents and the level of its combinations change with every variation in the type of structure which supports it. The developmental histories of mind and body have followed parallel courses the incidents of which are interlinked at every stage.

We commonly think of the central nervous system as the special physical mechanism with the elaboration of which the evolution of mind is primarily connected, yet it is to be questioned if this is not a mis-statement of the conditioning of mind upon its physical coefficient. The primary relation of the organism to its environment is that of a food consumer to its source of supply. Appropriative reaction is thus the basal activity with which all others are connected. But reaction is valuable only in so far as it is specific and intelligent, in the sense of being discriminative and selective. It must therefore be made under the guidance of sense. Discriminative sensibility makes possible the series of reactions upon which life depends. The number and quality of the objects upon which action is possible, as well as the range and character of the movements themselves, depend upon the nature and variety of the sense organs possessed by the organism. Sensation and movement are universally combined, in a unitary process which we describe as discriminative reaction, and this reciprocal relation between the organism and its environment was established long before the structures of the nervous system came into existence, and in manifold forms of life is maintained to-day in all its essential features in the absence of such a system.

The special purpose which the nervous processes serve is to

define and facilitate the reactions called forth by sensory stimuli. They consist of tracts of matter peculiarly sensitive to the propagation of impulses, which have differentiated from the primitive protoplasm and constitute the paths of habitual conduction between the point of stimulation and the mechanism of reaction. The development of such a system of paths is the necessary concomitant of the rise of localized reactions, and upon its presence depends that complex co-ordination by which any one of the whole series of sensory impressions to which the organism is susceptible can give rise to the same response, or a single stimulation arouse on different occasions any one of the whole series of reactions of which the animal is capable. But neither discriminative sensibility nor differential reaction can be regarded as a function peculiar to the nervous system, as both exist independently of its presence.

The possibility of the reflection of the world in consciousness is given in the differentiation of the sensory surfaces, and its realization depends upon the development of motor control. If it be justifiable at all to separate the constituents of a process so thoroughly unitary as the rise of the nervous system with its end organs of sense and movement, one should say that the evolution of intelligence depends upon the elaboration of the peripheral mechanisms rather than upon the central process, since in the former are given the materials and condition of development, while the function of the latter is to co-ordinate and transform the material thus given.

A special interest for the historical student of mind thus attaches not only to the evolutionary series in which the sensory apparatus of a given species takes form, but also to the system of mechanisms upon which its adaptive reactions depend. Among the instruments by which the activities of the mind are recorded and communicated none is of greater importance than the human hand. The function of expression centres supremely in the face, yet in a multitude of ways its message is supplemented by the action of the hands; while in all the more enduring records of intelligence the executive hand stands alone as the agent by which purpose is translated into plastic and tangible forms. The history of such a mechanism, at once so sensitive and so adaptive, is full of interest.

The structural evolution of the human hand has been outlined by the writer in another paper,[1] and the chief stages in its history may be summed up in a few words. This most highly adaptable member of the system of vertebrate limbs has successively fulfilled the functions of locomotion, support, suspension and manipulation. Having its rise in the lateral folds

[1] Popular Science Monthly, September, 1904.

of the primitive fishes the fore limb received aquatic modifications represented in the bi-pinnate, unilateral and prong-fins, and on land underwent successive cleavages of the latter form resulting finally in the five-toed generalized form of mammalian limb. Descending through the plantigrade type of mammal the extremity of the fore limb, in common with the hind members, was first moulded to form a grasping organ, the system of digits in its final arrangement presenting the phenomenon of opposition, as do most arboreal types, like the perching birds and the chameleon. This structural differentiation, upon which so much of the subsequent fortune of its possessors depends, is essentially a modification of the foot, and is indeed the only adequate solution of the problem of support upon a rounded limb which can practically be conceived. Though in man its traces have largely disappeared from the foot, opposition took place in all four limbs before the erect or semi-erect posture was attained, in which alone this modification could receive the functional significance which raised its possessor so far beyond all other organic types in manipulative and constructive processes. The human hand is thus one of the most striking instances in nature of the operation of adaptation to one specific function in preparing an organ for a completely new series of activities.

The freeing of the hand for manipulative and constructive uses was the concomitant of skeletal and muscular development in the legs and the attainment of the erect posture, and together with the latter modifications prepared the way of the ape-man for a return to life upon the plain after his arboreal habitat. The new mode of life, while it presupposed the capacity for free and sustained movements of locomotion, called chiefly into play activities depending upon a high brain development and involving distinct mechanical constructiveness. For the primitive man was neither well armed, nor fleet of foot, nor possessed of natural weapons sufficient to maintain himself among his fierce competitors, and must have depended upon the distinctly human attributes of cunning and skill, the linking of resourceful brain with a highly developed manipulative organ.

For an explanation of the subsequent fortunes of man and the higher apes repectively we must turn to the divergent histories of their central nervous systems. "Henceforth," to quote the closing words of that article, "no important structural changes are to occur in the general features of the hand. Development is to take place chiefly through an increase in the facility and precision with which a variety of relatively simple movements are made, and the substitution, in ever increasing

grades of complexity, of mechanical instruments for the use of the hand itself as a manipulative and constructive agent."

Even in its immediate physical features, however, the hand must not be conceived to have suffered arrest at this point. It is indeed henceforth to be the servant of the brain. The value of its services is not to rest chiefly upon its strength, nor its endurance, nor even upon the swiftness of its movements, but upon its delicacy and adaptiveness as an organ of perception, and the promptness, accuracy and refinement of the movements made by it under perceptive direction. Nevertheless for the fulfillment of these new functions further structural evolution must take place in the hand. Cerebral development is met by peripheral modifications through which progress both in discriminative perception and differential reaction is made possible.

One of these necessary changes in the hand is its denudation of hair. The hairy coat of animals serves both as a protection and as a sense organ, the latter especially in cases where the hairs are long, stiff and sparse. The sensitiveness of the skin to stimulation applied through the hair-shaft can be tested in a moment by touching with the lightest possible contact the hairs on the back of the hand. But though delicate these responses are far from refined. The stimulation of the sense of touch in this manner makes known the proximity of a physical object but gives practically no information concerning its character. The presence of a hairy covering, therefore, stands absolutely in the way of the development of discriminative sensibility in the skin. In lower mammalian types as well as in man the law is exhibited; the sensitive surfaces of the mobile, exploring members of the body are everywhere freed from hair. A clear, naked skin is the prerequisite for the development of perception through sensations of contact.

Parallel with this process must go the specialization of the hand in the delicacy of its integumentary covering. No refined manipulation is possible with a hard and calloused skin, since it entails the lack of that responsiveness to subtle and varied stimulation upon which differential reaction finally depends. Such a change cannot have taken place in the limb so long as it was called upon to share in the function of quadrupedal locomotion, or was even employed constantly in grasping the rough surfaces of the trunk and branches of trees to support the body in climbing. The bare foot becomes leather-soled and insensitive, the hand employed in heavy labor grows callous and obtuse. No matter how adequate the supply of sensory nerves to such a limb it must remain useless to its possessor so long as a horny plate is spread between their terminals and the source of stimulation. A thin and pliable

skin, free from hairs and callosities, is thus the first of the series of refined modifications which the hand must present in its later evolution as a factor in the development of intelligence.

The most sensitive surfaces of the hand are the palmar regions, and within this general area especially the tips of the fingers. Sensitiveness there is four times as great as in the palm and ten times as great as on the back of the hand. As a condition of the development of such a sensitively tipped rod a degenerative process in the protective sheaths of the finger may be pointed out. When the terminations of the functional digits are shod with a horny covering, stimulations are conveyed to the peripheral nerves of touch only in the form of vibrations produced by the stroke of the hoof upon the earth or other solid object. The resistance of the surface, in such cases, combined with auditory and visual perceptions, furnishes information concerning certain practical aspects of the object with which the horny integument comes in contact, but no sense of touch in the ordinary acceptation of the term is involved.

When the modification of tissue takes the form of claws, as in the cat tribe and rodents generally, the tips of the digits can be brought into contact with objects only when the claws have first been embedded to their full extent, which occurs only when the limb is employed for other purposes than perception, for instance, in digging, climbing and seizing prey. In such animal types only the upper parts of the balls of the fingers and toes commonly come into contact with surrounding objects, and their tips, secluded and protected by the curve of the claws, remain undeveloped as sensory organs. The elimination of the claw took place relatively early in the evolution of the hand. In the lowest of the arboreal types it has already undergone a large amount of atrophy, two only of the digits in the middle lemurs being thus provided, and in the highest species one alone, the second toe. In the monkeys proper all the digits are already furnished with nails.

In addition to modifications of the epidermis and its appendages the adaptation of the hand to complex perceptive and manipulative functions involves certain changes in the structural relations of the limb. These may be summed up as consisting in the elongation of the digits and the relaxation of the system of muscles which bind the phalanges of the hand together; in other words, the hand must become slender, supple and flexibly articulated. The function of these modifications is chiefly to increase the opposability of the various constituents of the hand. The flexible articulation of the digits supplements the significance of the thumb by making possible a more perfect opposition between it and each of the fingers sep-

arately, and also allows of a secondary opposition among the digits themselves, less adequate indeed than the primary opposition of each of these to the thumb, but still of much importance in the exploration and manipulation of objects. The length and suppleness of the fingers permit also of a more complete opposition, by flexion, between the system of digits and the palm of the hand.

The significance of these various modifications in relation to the development of intelligence lies in the fact that the process of perception is elaborated point by point in dependence upon a system of motor reactions, the character of which determines the form and adequacy of one's intuition of the world. Pure sensory apprehension does not exist; since that interpretation of sensation through which the construction of the external world takes place in the mind can proceed only on the basis of specific movements called forth by the stimulus, in virtue of which the connections of various items of sensation with particular experiences of movement and resistance are one by one established through actual exploration and testing, until finally each calls to mind at once its proper associate, and the field of perception becomes a system of intelligible symbols which is instantly and correctly interpreted.

The perceptual world as it is presented in consciousness at any moment is thus a complex product which can have arisen only from the manifold and repeated experiences of many past moments in which the sensory content has been subjected to experimental variation and associated with specific forms of self-activity and its objective limitations. The more variously we have reacted upon the physical world the more full of meaning is the system of sensory stimulations which it affords, and the more extensive and exact our discrimination of its characteristics and relations. To a being sensorially perfect but incapable of reaction upon its environment the world in which we live must remain a pure phantasmagory of shifting sensations, a dream not of things but of impalpable subjective visions. The world becomes real to us only in so far as we are active in relation to it.

The features of the perceptual world which the senses of a given animal reveal to it must therefore in a very intimate fashion be dependent upon the character of the exploring and manipulative organs with which it is furnished, as well as upon the range of its special sensation. The mechanical limitations placed upon its reactions are at the same time conditions which determine the form and extent of the interpretation which it can put upon the sensory impressions which it receives. Without delicacy of the sense organ itself, that is, without those structural differentiations of its surfaces, in virtue of which it becomes capable of responding by distinct physio-

logical reactions to a multitude of minute modifications in the stimuli which act upon it, no differential reaction would of course be possible, and the discrimination of objects would fall to the ground from the lack of its fundamental basis; but were the structural development of the sense organ never so perfect, it would still be functionally useless as an organ of perception so long as the refined control of its movements remained in abeyance. One cannot imagine a clear perception of visual form, for example, to exist for an animal incapable of those co-ordinated eye-movements by which the contours of objects are traced and retraced with exactness and facility.

The function of muscular control in the perception of objects and space relations is not limited to the adjustments of the sense organ immediately concerned. A part of scarcely less significance in the interpretation of sensations of sight and hearing is played by the exploring movements of the limbs. Here again the mechanical limits placed upon the range and exactness of reaction condition the translation of visual and auditory sensations into perceptions of sight and hearing. Imagine any degree of perfection one pleases in the optic qualities of the eye in an animal like the horse, one is still utterly unable to conceive of any such a world dawning upon its intelligence as that which is presented through our own senses. The mere fact of the callous hoof and clumsy limb is an impassible barrier to an understanding of the subtle and varied impressions which we have supposed the eye to be capable of receiving. With a physiologically perfect organ of vision the innumerable refined modulations of form and surface of which vision gives us instant apprehension would remain, in the blank gaze of the brute, an unmeaning confusion of light and color. Without the illuminating touch of the mobile and sensitive hand the shapes of the solid objects about us would never have detached themselves from the general background of the field of vision and arranged themselves in the elaborately figured relief in which, at a single glance of the eye, they are revealed to us.

We have imagined the existence of an organ of vision physiologically well developed but inadequately provided with mechanisms of motor control. Such a supposition is, however, historically unwarrantable. Under the conception of evolution, whether arising from the inheritance of acquired characteristics or as a result of spontaneous variations, the perpetuation of a particular sensory modification depends upon the furtherance it affords to the system of useful reactions which the economy of life comprises. In other words its usefulness to the animal, and hence its conservation as a character of the species, is based upon the possibility of differential reac-

tion to the new sensorial qualities to which its appearance gives rise.

The rank of the various sensory mechanisms in the scale of importance as perceptive organs will be found intimately dependent upon the character of the apparatus of motor control with which they are severally provided. The physiological differentiation of a part of the sensitive body surface is but the first step in the elaboration of a sense organ. For any real development it must be followed by isolation from the general mass of the body and provision with such muscular appendages as will make possible independent local reaction and the variation at will of the relation of the sensory surface to its sources of stimulation. It is this facility and precision of control in the sensori-motor apparatus which lies at the basis of the common distinction between higher and lower senses, and gives such functional superiority to sight and touch over taste and smell. The development of bodily control in the form of organic adjustments and movements of exploration conditions every advance in the mechanism of sensory perception. They probably do not in any case produce those modifications in which the evolution of the senses consist, but their adequacy or insufficiency affords the selective environment which determines whether the new variations shall survive or perish. The muscular mechanisms of the body must thus undergo progressive development if useful modifications of the sensory areas are to be made efficacious in the evolution of intelligence.

In conclusion, it is necessary only to recall to mind that the process by which the hand becomes capable of fulfilling its exploring and interpretative functions does not consist solely in the elaboration of its architectural features, namely, in the acquisition of a pliable skin and flexible members. The incorporation of these modifications depends upon a parallel development of the system of sensory and motor nerves supplying the surfaces and articulations of the hand. Each of these sets of structures is indispensable. Without a full supply of sensory nerves the surfaces of the hand would be obtuse, and refined discrimination of the features of objects become impossible. The insensitive skin would interpose itself between the intelligence and its object like an impenetrable veil.

This, however, is but half the story concerning the part which the sensory nerves play in the acquisition of knowledge in regard to the world of objects and space relations. These perceptions depend also upon sensations deriving from the process of adjustment itself, and not due to the nature of the contact between the hand and the surface of the object explored. It is to these kinæsthetic sensations chiefly that we owe our

knowledge of the disposition and configuration of the objects about us. The limb must be sensitive within as well as without, in tendons and articulatory surfaces as well as throughout the external skin. Without this refined sense of position and movement the world might present to us a series of experiences of variously textured surfaces but scarcely one of objects and distances. By means of kinæsthetic sensation and its residues all the familiar adjustments of our bodies are made. To the exploring hand it is as a second visual sense by which the pathway of perception is illuminated and the space relations of objects recognized.

Kinæsthetic sensation arises of course in connection with passive as well as active movements, so that changes in the position of a limb brought about by purely external agencies are discriminated with a fair amount of exactness. Its characteristic function, however, appears in relation to voluntary reactions and their systematic co-ordination. The possibility of linking muscular reactions in a system of harmonious and purposeful movements depends upon the incoming stream of sensations which these reactions themselves arouse. The control of each successive movement which is to take place is conditioned upon the sensing of the adjustment which has just occurred. The moment this system of resident sensations is eliminated the reactions fall back into the primitive chaos which is exhibited in the impulsive movements of the infant, unless, indeed, they be directed in some secondary fashion, as by the sense of sight.

The development of a refined system of motor nerves employing a sensitive and flexible organ under the direction of kinæsthetic sensation forms thus the internal differentiation upon which the progressive adaptation of the hand in the service of intelligence depends. Since every intellectual advance is conditioned upon the possibility of realizing in concrete form those more elementary conceptions from which it proceeds, it is perhaps not too much to say that the hand, through which alone this embodiment of thought and purpose is mediated, is of all bodily members the most human and most noble; and that in its features and capabilities is symbolized all that man has achieved in his long upward march from the primeval ooze.

LITERATURE.

The Mind of Man, by GUSTAV SPILLER. Swan Sonnenschein and Co., London, and The MacMillan Co., New York, 1902. pp. xiv and 552.

This book is a general treatise on psychology, "more especially designed for the use of students." The work has a serious mission, for it is a voice raised against "the amazing backwardness of psychology" to protest that not only have "the elementary principles of psychology . . . . still to be established;" but that, "from the scientific point of view, no serious attempt has yet been made in that direction." It "will have fulfilled its author's purpose if it accentuates the need of, and assists in establishing, a psychology of a strictly scientific character." The 'amazing backwardness of psychology' is said to be chiefly due "to its having been almost exclusively cultivated by philosophers or those philosophically inclined." To this general cause, may be added the psychologists' anxiety "to systematize that which they had not previously examined," the substitution of hypothesis for empirical data, the admitted failure of introspection (!) and the erroneous conception of experiment. The author's 'new' method involves minute observation completed by generalization. It should be added, however, that "psychology, jealously separated from physiology, ... cannot supply us with a consistent account of the facts of mind;" hence "it is in neurology, or brain science, coupled with introspection, that our hope ultimately lies." The new method is not to be confused, the author explains, with that used by "scholars of the psychological laboratory." "After reviewing what is practically the whole field of psychophysics," he draws the following vivid picture of the laboratory and its work. For the purpose of examining psychological facts experimentally, "laboratories are fitted up, containing the necessary appliances. All the customary scientific checks are employed. The number of experiments is recorded, as well as the persons experimented upon. The time of each experiment is determined by electric clocks which generally mark thousandths of a second and which are usually stopped by pressing a button on which the hand already rests. In short, these experiments are distinguished by an ingenuity and a care which is scarcely exceeded in physical inquiries." The picture reveals in a quaint but striking way the methods and the limitations of the artist. Such caricatures of the laboratory have almost disappeared, even from newspapers; one hardly expects them from the critic of psychological systems.

When Mr. Spiller drops the rôle of iconoclast and begins to write positively, his writing greatly improves. He offers as a definition of psychology the following statement. "Psychology treats of the nature and the satisfaction of those distinctive needs which are connected with the central nervous system, and this it treats of in systematic conjunction with the system of sights, sounds, smells, etc., which are developing concurrently, *i. e.*, psychology treats of the needs which arise out of the relations of the various systems in the organism, and out of the relations of that organism to its enviroment." The 'central needs' with which psychology deals are elsewhere defined as "functional tendencies inherent in the central system under the particular conditions of any moment." These needs are followed by processes which tend to satisfy them, but neither the need nor its satisfaction is necessarily conscious. "A complete psychology would, for instance, tell

us what is the effect of an empty stomach on the nervous system and proceed to enumerate the physiological changes which supervene until the requisite food reaches the stomach. Some of these changes would be represented by feelings, sensations and ideas; but the overwhelming majority of them would not be shadowed by any feelings which were directly observable. Thus one department of psychology would trace the physiological processes connected with central needs, while another would deal with the accompanying facts of feeling."

Now it is from the point of view of these central needs that consciousness is considered throughout the book. The need is the 'stimulus' to any given consciousness; and it is, moreover, its *raison d'être*. Consciousness is representative of organic function and can properly be understood only in the light of the functional tendencies that initiate, determine and control it. Instead of referring to 'consciousness,' however, the author usually employs the term 'system,' which he defines as "anything given whatsoever," *i. e.*, a sensation, a feeling, an image, a train of thought or action, or what not.

Systems once set into activity as the expression of needs on their way to satisfaction, may be considered from several points of view. (1) *Systems as distributed* (ch. ii), *i. e.*, as broken up, differentiated, in attention, without which a system exists only as a "vague detailless feeling." Attention is synonymous with 'neural activity.' "Its total quantity" is constant and limited. Distribution of systems rests therefore upon distribution of neural activity. (2) *Systems as organized* (ch. iii). Organization takes place in the form of habit and under the pressure of needs. "The needs of our nature are the source of organized trends of every description, as indeed of every task. They represent a definite neural sensibility which enables the work to proceed." "All habits and thoughts are more or less organized secondary complexes." The sanction for organization is found in its economy. "Attention energy is limited while our desires tend to be boundless." "Hence a struggle for the field of consciousness ensues, as a result of which thought is simplified." (3) *Systems as need-satisfying* (ch. iv). Under this heading, stand various effects of organization and economization upon the satisfaction of needs. The chapter is inconsequent and rambling. It seems to be the most convenient place in the book "to talk of many things." The author dwells, *inter alia*, upon the *terminus ad quem* as a factor in association (*cf.* Stout's 'continuity of interest'). (4) *Systems as redeveloped* (ch. v). Memory is considered as 'secondary' systems (reproductions) which play a part in the satisfaction of needs. Mr. Spiller here misses the opportunity to draw the natural functional distinction between perception and memory as resting upon different needs and different modes of satisfaction. (5) *Systems as disturbed* (ch. vi.). The disturbance of systems yields pleasure and pain and implies a decided loss of neural equilibrium, accompanied by a temporary disorganization of thought and action. It is "an exceptional state which has to be met in an exceptional way." The disturbance further implies a fundamental and urgent need for protecting the organism 'from swift disaster' and for restoring 'neural tranquillity.' But pleasure and pain are not the sole or even the usual determinants of thought and action. Thought and action are determined by 'our organized needs,' in general, which "normally realize themselves according to inherited and acquired inclinations, and not as the result of disturbances." In the author's collected "opinions of psychologists" on affective theory, one misses the names of Wundt, Münsterberg, Külpe, Meynert and Lehmann. Here, as elsewhere in the volume, there is a lack of perspective. (6) *Systems as need-determined* (ch. vii). This chapter contains the main thesis of the book; *i. e.*, that "psychology only knows of needs and the process by which

these needs satisfy themselves." It also contains an account of 'will' as expression of organized needs pressing for fulfillment. The present writer was disappointed that a frankly functional account of will should have been satisfied with a superficial classification of needs into 'perennial,' 'periodic,' 'personal,' 'peculiar,' 'political' and 'passing.' The list is also incomplete, closely as it presses the limits of alliteration. One looks, moreover, for a more exact and searching inquiry into how, in particular, needs are satisfied,—for a description of the need as it actually works itself out. (7) *Systems as unified* (ch. viii). This chapter includes a series of little essays—most of them immature or inadequate—on subjects connected, nearly or remotely, with the author's theory of monism, the monism of the school of 'Immanence.'

Chapter viii closes the part of the volume devoted to 'general analyses.' The next three chapters are brought under the somewhat ambiguous Spencerian rubric, 'special syntheses.' They discuss the dependency of the individual (especially the genius) upon social environment, and the organization of character through needs (*Systems as individualized*, ch. ix); the various levels of psychophysical activity, hard thinking, casual thought, dreams, hallucinations, the animal consciousness, etc. (*Systems as classified*, ch. x); and æsthetic apprehension as dependent upon a specific need furnished by the attention (*Systems as attention-determined*, ch. xi). The volume closes with a brief and succinct summary of the whole treatise.

Throughout the work just outlined, the author displays a happy gift of introspection. His pages, are, as a result, rich in illustrative material, for which psychologists of every school (save only those few who taboo introspection, interrogating by preference their apparatus instead of their observers) will be grateful. If one were to pass a general criticism upon Mr. Spiller's use of this material, one would say, however, that he employed it too little by way of illustration and too much by way of inductive proof. Take two instances. On the basis of casual observation of three orang-outangs who were watched "a few times for several hours together," the author makes the sweeping assertion that "we are therefore justified in stating that at least one species besides the human possesses intelligent thought determined by a continuous and equal current of neural energy," and, further, that "the various capabilities of the higher animals differ only in trifling details." Again, casual observation—by no means carefully made—of the visual after-image leads to general inductions regarding the conscious effects of retinal stimulation. Think of the years of serious painstaking work spent upon the after-image, and then consider the value of a few uncontrolled observations! Who would expect a student of physics to learn the laws of mechanics or of optics with such appliances as "a red table cloth and a lamp with a green shade?" The author fails to realize that the science of mind is as far removed from popular psychology as physics is from parlor magic. The viciousness of such teaching is not to be condoned, in spite of such guileless and humane recommendations as that the student himself observe and "experiment with domesticated animals carefully avoiding any unkindness."

Mr. Spiller, in attempting to introduce a new method and to remodel the psychological system, has proposed to himself a difficult task. The way of the revolutionist is hard, especially if the revolutionist, by wholesale denunciation of standard work, provoke the charge of rash amateurism. The psychological value of the book lies neither in its iconoclastic proposals nor in its method (which, in so far as it has scientific value, is not new) but in its point of view. It is the most frankly and consistently 'functional' psychology yet written. An 'activity' psychology always invokes some extra-psychological aid,

whether from 'unconsious ideas,' or 'association,' or 'dispositions,' or a 'self,' or a set of physiological functions. Our author has chosen to appeal to biology; to make consciousness a part of the response to, the reaction upon, a need, an unfulfilled function of the organism. The particular physiological powers invoked, the appeal to 'inmost nervous centres,' to 'neural momentum,' 'inclination,' 'disturbance,' etc., will hardly pass unchallenged by the physiologist, but the general procedure is legitimate and leads, moreover, to interesting and valuable results—if only these results be not confused with psychology as a whole. It leads to valuable results because consciousness, considered as a set of functions, performs at least a part of its work in the service of the organism and if it is thus considered, entirely without reference to the organism, the functions lose much of their significance.

Mr. Spiller's conception of consciousness as *habitual function* is deserving of notice. For him, consciousness appears, not in a moment of organic hesitation or indecision, where organization is insufficient for a presented emergency, but, on the contrary, as the expression of a ready-made and preformed process of reaction. Thinking is, on this theory, habituated reaction, and not essentially new adjustment or even delayed adjustment. "To act as we have acted before, is normal to all life," and "thought is the reproduction of what is relevant." It is not easy to reconcile this position with the commonly accepted view which correlates consciousness with readjustment, makes delayed reaction responsible for mental development, and discovers in learning the criterion of mind (*cf.* W. James, *Psychology*, I, 142; M. F. Washburn, *Phil. Rev.*, XIII, 622).

The psychology of *The Mind of Man*, may be called 'reactionism' in contradistinction to 'representative atomism.' In place of direct psychophysical analysis, it offers a series of combined 'systems' which appear as functional adjustments. Thought and action come as the answer to certain needs that have been laid upon the organism by the conditions of life. Reactionism—especially interesting at present because of its relation to pragmatic doctrine—and atomism imply complementary procedures in psychology. The former deals with psychophysical responses to organic demands; the latter analyzes consciousness into 'elements,' which it correlates with relatively simple forms of physical stimulus. The one emphasizes organic conditions of mind; the other, extra-organic conditions. The one refers consciousness back to functional habits of response; the other refers consciousness back to a world of physical objects playing upon the sensitive organism. The one emphasizes activity; the other analysis. The one exalts organic tendency to the neglect of external influence; the other exalts physical causes and conditions to the neglect of organic and organized response. Only a synthesis of the two positions can give a complete and adequate account of mind whether of man or of any other conscious creature.

Mr. Spiller has added to his book a good index and an extensive bibliography which is, however, neither complete nor representative of the whole field of psychological literature.

Cornell University. I. M. BENTLEY.

Principles of Physiological Psychology by Wilhelm Wundt; translated from the fifth German edition by EDWARD BRADFORD TITCHENER; Vol. I, pp. xvi+347. London: Swan Sonnenschein and Co.; New York: The Macmillan Co., 1904. Price $3.00.

The debt of English speaking psychologists to Prof. Titchener, already considerable, has been materially increased by the publication of the first volume of his translation of Wundt's monumental *Grund-*

züge der physiologischen Psychologie. Translation, to a man capable of good original work, is a heavy and sometimes unjustifiable sacrifice, but Wundt easily accessible to any one who can read English is something worth considerable sacrifice and something for which the translator's colleagues will not fail to be grateful.

That we have not had a translation long ago is not Prof. Titchener's fault. In 1890-91 he had already completed one of the third edition, but not before a fourth was in prospect. In 1899 again a complete translation of the fourth edition was given over in view of the present fifth edition. The translation now published is a fresh one of the entire work, the others having been wholly discarded. Such an experience is hard for the translator, but gets its reward in the quality of the final product.

The original fifth edition of the Grundzüge consists of three volumes (pp. 553, 686, 796) and an index (pp. 134). The first volume of the translation covers 338 pages of Vol. I of the original, embracing the "Introduction" and "Part I: On the Bodily Substrate of the Mental Life," together with a ten-page section on "Pre-psychological Concepts" which is found in the fourth edition but not in the fifth, and a volume index of names and subjects.

As a matter of course the work has been carefully and conscientiously done. In point of training, experience and sympathy Prof. Titchener is uniquely fitted for his task. Translator's footnotes have been added sparingly: in some cases for the special rendition of difficult terms, in others for references to English versions of works cited (*e. g.*, to Jowett's Plato), in still others for bringing the statements of the text into harmony with recent discoveries in embryology and neurology. Perhaps the utter impossibility of turning Wundt's German into intelligent English by a literal translation, perhaps the enforced revisions of the English version, perhaps the translator's veteran skill, perhaps all of them together, have made the style less angular than that of Külpe's manual some years ago, and therefore much pleasanter reading—a point of no small importance in a work of this kind.

It is hardly necessary to add that the psychologist who has not already facile use of a copy of the original should possess himself of the translation, even if he should have to suspend his subscription to the *American Journal* to purchase it! E. C. S.

PSYCHIATRY.

DR. ISADOR H. CORIAT.

RECENT LITERATURE ON THE PATHOLOGY OF DEMENTIA PRÆCOX.

The feeling that there must exist an anatomical basis for the production of various psychoses, will perhaps explain the recent studies devoted to this end in dementia præcox. Kahlbaum has already reported at length the results of seven autopsies in katatonia, in which the microscopic examination was negative, while Alzheimer and Nissl in the same disease found a neuroglia increase, especially in the deeper layers of the cortex. W. R. Dunton (American Journal of Insanity,

Jan., 1903), made an exhaustive examination of the central nervous system in a case of the katatonic form of dementia præcox of four years' duration, with death from pulmonary tuberculosis. The cranial bones were thickened and the dura free. The cortex was firm and of even consistency, but in the right hemisphere the episylvian sulcus was found to be markedly developed, while the paracentral convolutions were noticeably narrow. Sections from the frontal, temporal, paracentral, Broca's, the anterior and posterior central convolutions, cuneus, hypophysis, angular gyrus, caudate and lenticular nuclei, facial area, cerebellum, lumbar and dorsal cord and the spinal ganglia disclosed the following findings. Slight cell changes were found everywhere, being most marked in the first frontal convolution. These changes consisted of central chromatolysis, a slight degree of pale yellow pigmentation, slight cell atrophy, dislocation and swelling of the nucleus and folding of the nuclear membrane. The deeper layers seemed to be mostly affected. Phagocytosis was well marked and there was slight increase of neuroglia nuclei, but no changes in the medullated fibres and no marked vascular changes. Drawing his conclusions from the study of this one case, the writer says, "The positive findings are suggestive and seem to me to indicate the lines upon which further research can be best carried out for future study of this class of cases."

Dunton's second paper (American Journal of Insanity, April, 1904) relates to the case of a female, aet. 47, with a tubercular heredity. There was increasing dementia and rapid and extreme emaciation, the weight in 8 months decreasing from 180 to 90 lbs. A few days before death there were noticed muscular movements, general coarse tremor and at times clonic movements of the extremities. The dura was adherent over the region of the first frontal convolutions; the brain was symmetrical, the convolutions somewhat atrophied and there was engorgement of the vessels. The specimens for histological examination were taken from the same regions as in the first case. The cells in the cortex showed the following changes; increased pale yellow pigment, frequent central chromatolysis, cell often swollen, atrophied, displaced and distorted nuclei. In the cerebellum, there was a decrease of the Purkinje cells, which were distorted and atrophied and had a granular appearance, while the nuclei were distorted. "Ghost cells" were present. There was an increase of the tangential fibres; the neuroglia sections were unsuccessful, but an increase of neuroglia nuclei was observed by other stains. In using the polychrome stain, the white matter on decolorization, retained its color longer than the cortex, and this indicated to the author some unusual chemical change in the brain.

From his study of these two cases, and from the literature reviewed in the papers, the author considers that the pathology of dementia præcox is being established. The nerve cells in the cortex diminish in dementia as in idiocy, with possible changes in their orientation. He inclines to the hazy auto-intoxication hypothesis, as the possible etiological factor concerned in these changes. These chromatolytic cell changes described by Dunton are by no means constant or pathognomonic for dementia præcox. They have been found in a multitude of other conditions; general paralysis, delirium tremens, facial paralysis, Landry's paralysis, alcoholic neuritis, tetanus, typhoid fever, pellagrous insanity, phosphorus poisoning, fish poisoning with grave gastro-intestinal symptoms, carcinoma in the vagus nucleus, in diphtheria, and in various terminal delirious and depressive states. This last, when associated with emaciation, diarrhea, cachexia, motor weakness and twitchings or rigidity, may form the terminal complex of any primary mental disorder. It may occur in dementia præcox, but is found

especially in those psychoses around the climacteric period, and this end symptom-complex is termed central neuritis by Dr. Adolf Meyer. The cell changes in these cases (chromatolysis, "axonal reaction"), are associated with degeneration of their corresponding sets of fibres. In both of Dunton's cases there was extreme emaciation, while in the second, there was noted tremor and clonic movements of the extremities a few days before death. The cell changes in both these cases, therefore, are in harmony with the clinical and anatomical picture of central neuritis; the process is a terminal one merely, neither the result nor the underlying cause of the psychosis itself, but modified by an intercurrent disorder. In one of our own cases of typical central neuritis, a careful examination of the urine, both chemically and physiologically, failed to reveal any toxic products.

Lubouchine (Modifications anatomo-pathologiques de l' ecorce cerebrale dans deux cas de Démence Precoce, Journal de Neuropathologie et de Psychiatrie du nom S. S. Korsakoff, 1902, livre 1-2. P. 61–72) in two cases of dementia præcox finds atrophy, and pigmentary and fatty degeneration of the cells, some disappearance and degeneration of the tangential and subcortical fibres, enlargement of the peri-vascular spaces, proliferation of neuroglia in the molecular layer, in the layer of the small pyramidal cells and around the blood-vessels.

Bridier (Essai sur l'Anatomie Pathologique des Démences. Thése de Lyon, 1902), states that in whatever form of dementia, the lesions in the cortex are practically the same, and involve the nerve cells, the supporting tissue and the vessels. These lesions consist of fatty and pigmentary degeneration, central chromatolysis, division of the cell nucleus, and later atrophy of the cell body. There was also proliferation of the neuroglia in the layer of pyramidal cells, appearance of migratory elements and arterio-sclerosis of the blood vessels.

Klippel and L' Hermitte (Démence Precoce, Anatomie Pathologique et Pathogénie, Revue de Psychiatrie et de Psychologie Experimentale. Fev., 1904. No. 2) examined four cases of dementia præcox for the size of the cell bodies, drawing and measuring a fixed number of pyramidal cells in the motor zones and association centres. They found some anomalies of the fissures, absence of vascular changes and no neuroglia increase, the cells of the frontal cortex and the pyramidal cells were smaller than normal and showed marked chromatolysis and pigmentation with dislocation of the nucleus. In two cases assymetry of the cerebellum was noted. The atrophy of the cells was limited mostly to the association centres, and the various changes were looked upon as the result of long continued but rather weak pathogenic agents, of an unknown nature.

It seems to us that these few cases are far from establishing any definite anatomical basis for dementia præcox, and do not explain the characteristic symptomatology of this disease. Besides, the group is a wide one and there is some uncertainty whether we are dealing with a clinical entity, and further observation may establish independent subdivisions. Until then our efforts are premature, we are not justified in drawing an anatomical conclusion, or endeavoring to establish an organic basis for the disease. The recent isolation of a specific micro-organism from the blood in katatonia, needs only to be mentioned, to perceive it's absurdity. Possibly physical chemistry or the application of the side-chain theory may throw some light on the question.

GANSER'S SYMPTOM.

This is one of the interesting questions of contemporary psychiatry. Ganser first published his observations on random replies in 1897, and since then there has arisen much discussion as to whether these replies are of a hysterical or katatonic nature. Ganser looked upon

it as a hysterical symptom, Raecke thought it to be merely a stigma of hysteria, Nissl as katatonic negativism, while more recently Henneberg (Ueber das Gansersche Symptom.—Allg. Zeit. f. Psychiatrie. Bd. LXI, H. 5, 1904), in a record of thirteen cases showing absurd replies found that the syndrome occurred not only in hysterical stupor and dreamy states, but also in manic conditions, melancholia and dementia præcox. The most striking thing is the absolute absurdity of the replies, even to the most simple questions, the names of familiar objects or in simple calculation. The patient listens attentively, understands the question, tries hard to give a correct answer, but in spite of himself the replies astonish us by their absurdity. A few details of a case from Henneberg's series (Case 13), may perhaps serve to make this more clear. How many legs has a dog? "Five legs." A horse? "Also five." A crow? "I have not seen any." A sparrow? "It has also four feet." 2×2?="5." 2×2?="6." 2×5?="8."

Soukhanoff has given a very excellent résumé of the entire question (Sur la Syndrome de Ganser ou de Symptomo-Complexus des Reponses Absurdes, Rev. Neurol., Ann. XII, No. 17. Sept. 15, 1904). According to him, this syndrome differs from cases of mental confusion, where the replies are absurd, in that they are few in number. He believes it to be part of the category of hysterical disorders, but believes it may also accompany dementia præcox. Cases which show the syndrome do not terminate by recovery, but evolve towards a psychic state of doubtful prognosis, not necessarily deterioration, as no case of hysteria deteriorates. It is an associational disorder, and when the patient starts to reply, ideas of another order suddenly surge up in his consciousness. In hysterical paralysis, one often observes a loss of function of isolated muscles, simulating an organic lesion, and in Ganser's syndrome we have a partial analogue, but it takes place in the association apparatus, it is a partial memory disorder, a disorder of the superior logical mechanism. The question of simulation in medico-legal cases, where random replies are given in an otherwise connected production, is also of special importance.

Description of the Brains and Spinal Cords of Two Brothers. Dead of Hereditary Ataxia. (Cases XVIII and XX of the series in the family described by Dr. Sanger Brown with a Clinical Introduction by Dr. Sanger Brown.) By LEWELLYS F. BARKER. Decennial Publications of the University of Chicago, 1903.

The clinical report of the series was first published in 1892, and two of the histories are here reproduced in detail with the symptoms that have since appeared. In addition, a short résumé of the symptomatology of the disease is given. The anatomical findings, especially the description of the convolutions and sulci of the two brains, are given in great detail, not only on account of the rarity of the condition, but as the cases afforded an excellent opportunity for the topographical comparison of the brains of two brothers. The summary of these two cases shows the brains and cords to have been relatively small, the cerebral cortex was well fissured and showed no deviations from the normal type. In the cord, measurements showed an abnormal ratio between the areas of gray and white matter, as revealed in cross sections. There was a marked degeneration of the gray and white matter of the spinal cord, medulla and cerebellum and involved chiefly the cells and fibres of the centripetal paths. In the cord, there was an increase in glia tissue. It is hoped in a future paper to enter more fully into a discussion of the relation of the lesions to the clinical symptoms. The paper is illustrated with twelve plates, comprising in all forty-six figures of great typographical excellence.

An Experimental Study of the Physiological Accompaniments of Feeling.—L. P. BOGGS, Psychological Review, Vol. XI, Nos. 4-5, pp. 223-248.

This is the result of studies made for the purpose of testing Dr. Max Brahn's tridimensional theory of feeling. Marey's sphygmograph and the pneumograph were used. The writer concludes as follows: Strain is accompanied by a decrease in the length of the pulse curve, while the dicrotic wave becomes lower. Relaxation is accompanied by an increase in the pulse length and a heightened dicrotic wave. The state of attention is accompanied by a feeling of concentration, partaking of the nature of strain, and has parallel physiological processes resembling those of strain and relaxation, but the characteristics are less marked. The breathing in both the feeling of strain and relaxation is more rapid, regular and shallow than in an indifferent state. Pleasantness is accompanied by a larger and higher pulse curve; unpleasantness by the reverse. Excitement and repose are accompanied by less marked changes in the vaso-motor system than the other feelings and with practically no change in the pulse frequency. The excitement-strain feeling shows characteristics of the curves of both, while the excitement-pleasure feeling is pretty constant in showing a lengthened and heightened curve. The curves for excitement-unpleasantness have no constant characteristics. Repose-unpleasantness is accompanied by no constant marked characteristics, but unpleasantness-repose is accompanied usually by a shorter and decidedly lower pulse curve. When the feelings are mixed, pleasantness and unpleasantness do not appear until after those of excitement and repose. The time of the appearance of the feeling of strain depends on the the time it takes for the concentration of the attention to the stimulus. Sometimes it appears almost at once, and again two or three pulses later. When it appears in a mixed feeling, it comes later than in the others. The rhythm in the pulse lengths which correspond roughly to the act of breathing, tends to disappear during states of attention and the more so the stronger the feeling of strain and relaxation or of concentration. [Work much along the same lines has been conducted by Sommer (Beiträge zur psychiatrichen Klinik. Bd. I. H. 3. Nov. 3, 1902) on the measurements of the motor accompaniments of psychical states and by N. Hirschberg (Ueber die Beziehungen psychischen Zustände zum Kreislauf and zur Athmung, St. Petersberg Med. Wock., 1903., No. 2). The latter, as the result of elaborate experiments on normal individuals and in those suffering with mental disease, found that every mental state, whether normal or abnormal, was associated with characteristic changes in the pulse and respiration.]

Lectures on Clinical Psychiatry. EMIL KRAEPELIN. Translated by Thomas Johnstone. London, Baillière, Tindall and Cox. 1904.

This is a translation of the Einführung in die Psychiatrische Klinik, and it forms an excellent clinical companion to the Lehrbuch. Certainly, for the novice, who wishes to obtain an insight into clinical psychiatry, it is to be preferred to the larger text book. The work comprises in all thirty lectures, and includes all the forms of mental disease. The cases selected for demonstration and discussion are not of a very complex type, in order to more clearly elucidate the peculiar symptomatology and differential diagnosis of each form of mental disease.

Das Delirium Alcoholicum Febrile Magnan's. DR. ALZHEIMER. Centralblatt für Nervenheilkunde, Bd. XXVII, No. 174, July, 1904.

Alzheimer has observed three cases among 160 of alcoholic delirium.

All were schnapps drinkers and the mental symptoms followed an early and serious epileptiform attack, the temperature rising to 41.8° C. and death supervened in several hours. The clinical picture was that of a severe delirium with marked motor restlessness, clonic spasms of the limbs, ataxia, paraphasic speech disturbances, heart weakness and cyanosis. At autopsy there was found cirrhosis of the liver, fatty degeneration of the kidneys, degeneration of the Betz and Purkinje cells, slight neuroglia proliferation, small cortical hemorrhage and grave alterations of the capillaries, but no traces of any inflammatory process.

Un Cas D'Amnesie Continue Avec Asymbolie Tactile, Complique D'Autres Troubles. B. BOURDON and M. DIDE. L'Année Psychologique, 1904. pp. 84–115.

The authors relate a very valuable and interesting case of tactile asymbolia, and it may be well in this connection to call attention to Liepmann's famous case of one-sided apraxia (motor asymbolia), since it has lately come to autopsy. (Das Krankheitsbild der Apraxie motorischen Asymbolie, auf Grund eines Falles von einseitiger Apraxie. Monat. f. Psychiatrie und Neurologie. Bd. VIII. H 1, 2, 3, 1900.) Bourdon and Dides's patient was a man 54 years of age, with a negative family history, married, and the father of three healthy children. He never had any serious illness; had received a fair education and was able to read and write. Four months after entering the hospital at Fougères, he had an episode in which he became violently agitated and was transferred to the Asylum at Rennes on April 19, 1902. Without any shock that could be observed, there suddenly occurred on May 3, of the same year, complete word blindness without mind blindness. He recognized and correctly named objects which were shown him, there was no word deafness or agraphia, he was able to write his name spontaneously and could write correctly from dictation, but copying was impossible. He also showed a tactile asymbolia (loss of the faculty of recognizing objects by touch) and a moderate degree of astereognosis (loss of the faculty to recognize the shape of objects by touch). On Sept. 9, 1902, there was a slight shock, the patient became confused and showed nearly complete word deafness. This symptom diminished, but on Oct. 16, there supervened another agitated episode, he pronounced disconnected words and threw objects about the ward. From this he went into a state of religious exaltation, in which he kneeled and prayed a great deal and pronounced phrases devoid of sense. Once he said, "I am not an idiot, do not try to mix me up." On March 10, 1903, there was another slight shock, the mouth was turned slightly to the left, the eyes to the right and the cheeks were flaccid. He lay in a stupor, completely unconscious, the legs were drawn up and the reflexes exaggerated. He improved rapidly within the next few days and recognized and correctly named his relatives when visited by them.

ANALYSIS OF THE CASE.

An examination of the eyes showed the fundus to be pale, there was a narrowing of the visual field and probable diplopia, but no dyschromatopsia. Hearing was not impaired. Taste was good, but he was unable to name the solutions. Smell was fair, and although he could not name all the odors, yet he reacted well to disagreeable ones. The pressure sense was diminished, the temperature, pain and weight sense were normal. In tests for the tactile sense, the results were confusing. The muscular sense of position was intact. In testing the *stereognostic sense*, it was found that he did not know simple objects, but at times could recognize them, better by sight and touch associa-

ted, than with touch alone. At times, when he did not seem to know an object, he was unable to recall its name. By touch alone he easily identified such impressions as dry, rough, moist, and with more difficulty the forms square, round or the nature of an object (wood, metal), or the totality of an object (knife, hat). When the eyes were covered, and figures traced on the skin, he failed to recognize them; neither could he recognize by touch alone such objects as knife, scissors, hat, although he knew that the latter was something for his head. He knew a wooden triangle had three points, but he was unable to name it. He called a knife "a sponge" a box of matches, "a pen," but he was able to remove a match from the box and light it correctly.

He was able to distinguish the difference in the size of objects, but did not know their form. Simple objects were recognized, but he named them with difficulty or not at all. He recognized ordinary sounds (ticking of watch, clapping, grunting), and also popular songs. There was a general enfeeblement of the muscular force, as shown by the dynamometer. There was no Romberg. Orders for movements were executed only fairly well, due to a certain degree of word deafness, as shown by the following specimen of conversation. What is your name? "Laigre." How old are you? "Laigre." How old are you? "Oh, yes." How old are you? "Laigre." Letter and word blindness were nearly complete. He had some difficulty in pronouncing long words. He could not name simple letters, either written or printed, could not copy and was able to write spontaneously only his own name. The inner language (counting mentally) appeared to be fairly well preserved. He was disoriented for time and place and was unable to find his bed on the ward or his accustomed place at the table. He gave the alphabet correctly, named the months, days, Lord's Prayer and the ten commandments and was able to count but not by twos. The remote memory was not especially impaired. The patient died soon after these examinations, but the examination of the brain is not yet completed.

The *summary* of the case presents the following chief points: There is nearly complete letter and word blindness, but very simple objects are recognized by sight, therefore there is no mind blindness. The stereognostic sense shows a deep disorder. The patient easily identifies such impressions as dry, wet, etc., but he fails to recognize by palpating alone, unless he sees them at the same time, such objects as knife, scissors, hat, etc. He is unable to distinguish his right from his left hand. Although he understands simple, elementary sounds, yet word deafness exists. The movements of the hands are badly executed and slow. Speech is preserved, but there is paraphasia. He is able to write, but cannot copy, as he has lost the faculty to read and also to reproduce very simple figures by design.

It is necessary to distinguish the disorders of perception of the isolated properties of an object, from those of an object in its totality. Astereognosis is found in paralysis, ataxia and chorea and is the result of motor disorders. It also may occur in cortical lesions, which Wernicke has called primary identification. Tactile asymbolia is tactile blindness, that is, a rupture of associations between the centres of musculo-tactile images and the centre of visual images. The stereognostic perception comprises a plurality of sensations. Goldscheider (Physiologie des Muskelsinnes, 1898) shows that articulations and tendons have three elementary sensations, viz.: movement, weight, and resistance. According to him, it is the deep articular sensibility in which lies the sensation of movement. He considers the sensation of weight as a sensation of tendons, while the sensation of resistance is produced by the pressure of the articulations against one another.

Memory also enters into the stereognostic sense, and it is necessary to make the following distinctions, viz.: disorders of immediate memory, amnesia for recent and remote events, a failure of fixation of memory for recent events, and retrograde and ante-retrograde amnesia. From a pathological standpoint, the amnesias may be classified as follows: (M. Dide–Essai de Classification des Amnésies, Bull. de la Société Scientifique et Medicale de L'Ouest, 1903, p. 456.)

1. Amnesias due to a general enfeeblement of the intelligence, the memory diminishing progressively and in a parallel manner with the other elements of the intellect, as in general paralysis.

2. Amnesias due to alterations in the sensory sphere, in particular in the visual cortical sphere, which shows that very limited lesions in the visual cortical region give the clinical picture of continued amnesia, or there may arise a loss of topographic ideas (topagnosia) in amnesias due to the same lesion. These occipital amnesias, may be divided into agnosias, if the formation of mental images does not take place (psychic blindness) and into aconamesias, if the image is obliterated while being formed (amnesias by fault of fixation).

3. Amnesias due to mental confusion (intoxication, epilepsy, uremia, acute alcoholism, polyneuritic psychosis).

4. Amnesias due to a diminution of the capacity of attention and a weakened will power (amnésies abouliques) as may occur in neurasthenia and certain melancholias.

Applying these data to the case in question, the authors claim that perhaps the marked degree of tactile asymbolia, is in great part the outcome of the enfeeblement of the immediate memory, of the memory for recent events, and of the poor motor co-ordination of the hands. The patient handled an object poorly and he took a long time to palpate his hands over the contours of an object, and in this manner he forgot that he palpated a certain part of the object. The different sensations did not come together, and therefore he was unable to produce a mental picture of the object in its totality (lack of the "sense of fusion"). The hypothesis that tactile asymbolia results from a destruction or enfeeblement of the visual images is perhaps true, because objects seen were easily recognized. There is a rupture of associations between the centres of tactile and those of visual images. The anatomical findings may perhaps clear up some perplexing problems in localization.

BOOK NOTES.

Psychology. An Introductory Study of the Structure and Function of Human Consciousness, by JAMES ROWLAND ANGELL. Henry Holt & Co., New York, 1904. pp. 402.

Instead of devoting his energy to investigating the structure of mind this author deals more with its functional and genetic phases. He is quite as interested to determine how consciousness develops and operates as to discover its constituent elements. It is designed as an introductory text book. After treating problems and methods, the psycho-physical organism of the nervous system and the relations of consciousness to neural action, the author passes to attention, discrimination, association, sensation, perception in its spatial and temporal relations, imagination, memory, meaning and concepts, judgment, forms and functions of reasoning, the affective elements, feeling, reflex action, instinct, nature and a general theory of emotion and volition, and the relation of the latter to interest, effort and desire, character and will, and finally self. The book is attractively gotten up and we may readily pardon the author for giving somewhat undue space to the topics he has himself especially investigated.

An Introduction to Psychology, by J. CLARK MURRAY. Little, Brown & Co., Boston, 1904. pp. 517.

The author's handbook of psychology passed through several editions with little change. It is here issued under a new title after a revision that involved the entire rewriting of many parts. The general plan of the old book, however, remains the same. Under the first division, "General Psychology," the elements of mind, special senses, mental processes, association, suggestion, comparison, etc., are treated. Under "Special Psychology," cognition, perception, abstraction, reasoning, ideation, illusion, relativity of knowledge, feelings, and finally, volitions, are characterized. The work is a good and able statement of rather old-fashioned mental philosophy. It appears to represent the intellectual life of a professor of this subject with many years of honest, earnest labor as a teacher behind him.

Interrogative Thought and the Means of Its Expression, by EDWARD T. OWEN. Transactions of the Wisconsin Academy of Science, Arts and Letters. Vol. XIV. Madison, 1903. pp. 356-470.

The main results of this investigation exhibit the question as the final term in a crescendo consisting of expressions, first, suggestive, giving only what is conceived; second, assertive, vouching assurance of the conception; third, imperative, assurance of desire, and fourth, interrogative, giving assurance of desire for information as to what is conceived. The work as a whole consists of an admirable but somewhat minute analysis of what in both thought and expression is involved in interrogation.

Untersuchungen zur Gegenstandstheorie und Psychologie, von A. MEINONG. Johann Ambrosius Barth, Leipzig, 1904. pp. 634. Pr. M. 18.

This is a memorial volume celebrating the close of the tenth year of the psychological laboratory at the University of Graz. It con-

tains eleven investigations as follows: On the Theory of the Object; on the Basis of this Theory; on Investigations in Measurements; on the Economy of Thought; on the Psychology of Comprehending Forms; on the Distraction of the Checker-board Pattern; a New Proof of the Specific Brightness of Color; Production of Conceptions; the Absolute; the Strikingness of Colors; and Anti-voluntaristic Basis of the Theory of Youth; and on the Nature of Fantasy, Feeling and Desire.

Analytic Interest Psychology and Synthetic Philosophy, by J. S. ENGLE. King Bros., Baltimore, 1904. pp. 295.

This whole work is based upon an introspective study of the principle of interest in the mind together with a critical examination of psychological teaching. What is called the interest-movement is the basis of meaning. "In all consciousness the new glint of meaning is incubated by the aid of instinctive interest-movement processes flashing in their instinctive meaning-glints until this particular interest movement bursts into a new glint of meaning, *i. e.*, a judgment-burst or new meaning-glint." The categories are explained by meaning-survivals. The author also has a new apologetic for the New Testament. We do not pretend to have fathomed all the depths of this attempt to reconstruct the whole philosophic field. The author has not written himself clear, has evidently read and thought in somewhat restricted fields, but his book is not without significance as expressing the sense of a vigorous, youthful mind that radical new constructions impend.

Psychology: An account of the principal mental phenomena with numerous examples, by ALFRED COOK. Hinds, Noble & Eldredge, New York, 1904. pp. 386.

The author is eminently a "free lance." Here are his sixteen chapters: Sensation, Perception, Fantasy, Memory, Imagination, Conception, Judgment, Reason, Systematization, Invention, Volition, Desire, Affection, Emotion, Destiny, Origin. The author lets himself go in a very remarkable way, and deals far more lavishly with illustrations than with definitions. Ancient history and mythology, science, commerce, agriculture, music, art, religion, poetry, abound and make the book at least chatty. We should like immensely to see how this book would work as a text for any class or grade of students. It is intended to be eminently teachable, and to be an introduction to the studies of the mind.

Archiv für die gesammte Psychologie. Herausgegeben von E. Meumann. IV, Band, 1. u. 2. Heft. Wilhelm Engelmann, Leipzig, 1904. pp. 288+32.

In this interesting number Meumann and Ebert discuss the basal psychological question of practice in the field of memory, and Geiger treats of the psychology of the emotional factors and their connection. Interesting reviews follow.

Archives de Psychologie. Publiées par Th. Flournoy et Ed. Claparède. Tome III. No. 12. Juillet, 1904. H. Kündig, Genève, 1904. pp. 416. 3 fr. 50.

Trabajos del Laboratorio de Investigaciones Biologicas de la Universidad de Madrid. Publicados por S. Ramón Cajal. Tomo III, Diciembre, 1904. Nicolás Moya, Madrid. pp. 297.

This volume is a continuation of this author's compendious work describing his own researches on the brain and the nervous system based upon the investigations in his own laboratory The articles are

Physiological Mechanism of Natural Immunity; The Neurofibrillar Reticulum of the Retina; Lesions of the Reticulum of the Nervous Cells in Rabies; New Methods of Staining Neuroglia and the Neurofibrillæ; the Morphological Variations of the Nervous Reticulum of Invertebrates and Vertebrates under the influence of Natural Conditions.

Travaux des Années 1903–1904, publiés sous la direction de A. Mosso. Laboratoire de Physiologie de l'Université de Turin. Extraits des Archives italiennes de Biologie, t. XL–XLI. Hermann Loescher, Turin, 1904. pp. 212.

In this volume we have a number of studies interesting for the psychologist. The first is by Kiesow on the velocity of stimulus in a sensory nerve. Other topics are the variations in the alkalinity of the blood on Mt. Rosa, the action of spinal sense on the tonicity of the muscles of respiration, on apnœa produced by oxygen, on the arrest of respiration in asphyxia, a theory of tonicity based on double innervation.

Der Scheintod der Neugeborenen, II. Klinischer Theil, von LUDWIG KNAPP. Wilhelm Braumüller, Leipzig, 1904. pp. 179.

This monograph treats first of the idea and definition of the apparent death often observed in new born children. Later chapters discuss its physiology, pathology, ætiology, statistics, diagnosis, symptomatology, its immediate and later results, its prognosis, prophylaxis, and treatment. To each topic a valuable bibliography is appended.

Ueber das Studium der Sprachkurven, von E. W. SCRIPTURE. Annalen der Naturphilosophie. 4th Vol., p. 28-46. Veit & Comp, Leipzig, 1904.

Moths and Butterflies, by MARY C. DICKERSON. Ginn & Co., Boston, 1901. pp. 344.

Here we have an insect book of an elementary nature interpreting habit and structure as responsive adaptations to surroundings and as interpreting signs of blood relationship. The author has had much experience in teaching grammar grade students in this subject, but she has the fatal error of the pedagogue that the number of topics and range must be sacrificed to thoroughness of method. Happily, however, she does not carry this principle, which has trivialized so many text books, so far as to interfere with the really great merit of her book. Ten butterflies, ten moths, with several varieties given of some species, are first of all set forth, and then in the third part relationships and practical suggestions follow. The book is illustrated with 233 very good cuts. On the whole the work is a valuable addition to the resources of the teacher in these fields.

The Eyes of the Blind Vertebrates of North America. The History of the Eye of the Blind Fish Amblyopsis from its Appearance to its Disintegration in Old Age, by CARL H. EIGENMANN. (Contributions from the Zoölogical Laboratory of Indiana University, No. 50.) Reprinted from the Mark Anniversary Volume, Art. IX, pp. 167-204. 1903.

Contributions to the Study and Behavior of Lower Organisms. By HERBERT S. JENNINGS. Published by the Carnegie Institution of Washington, D. C., 1904. pp. 256.

All students of the psychic life of lower organisms will welcome this stately volume, collecting and unifying, as it does, the many valuable studies of Prof. Jennings. Many of them, as they first appeared,

have been already reviewed in our pages. Together they constitute a contribution of great value.

Annual Report of the Board of Regents of the Smithsonian Institution for the year ending June 30, 1903. Government Printing Office, Washington, 1904. pp. 876.

This volume, just out, spreads before its readers perhaps the most interesting bill of fare that the Institution has ever presented. The list of plates alone covers four pages and the appendix contains some fifty articles that have been extremely well selected and are of great interest.

Multiple Personality. An Experimental Investigation into the Nature of Human Individuality, by BORIS SIDIS and SIMON P. GOODHART. D. Appleton & Co., New York, 1905. pp. 462.

The most interesting part of this book is the very detailed description of a case of a vigorous and educated man who by an accident lost all record of his earlier life and was systematically observed and educated for a few months until, after an alternating period, the normal existence arose again from the unconscious. Few cases have been more fully studied and are more interesting. In the third part, entitled "Consciousness and Multiple Personality," many other cases of an analogous kind are briefly referred to and various conclusions are reached concerning the hypnoleptic state which are not, however, especially new.

Grundlinien einer Psychologie der Hysterie, von WILLY HELLPACH. Wilhelm Engelmann, Leipzig, 1904. pp. 502. Pr. M. 9.—

The writer first describes the development of the problem of hysteria from Charcot. He gives the idea of the disease, the logic of its psycho-pathology. In the second part he passes to analysis, discussing here suggestion and psychic causality, the hysterical disturbances of emotion and sensation, the hysterical intellect, the psychophysic law from the standard of the psychology of hysteria. In the third part, which is far more interesting, the genesis of the disorder is discussed. Its sources are found in the psychic conditions of the child, in excessive pressure, and readiness to be influenced. Auto suggestion helps unfoldment of the hysterical state, and suggestibility often leads to a divided ego. The plastic age is that which is most liable. Very interesting are the processes of overcoming this distemper.

Beiträge zur pädagogischen Pathologie, von ARNO FUCHS. V. Heft: Dispositionschwankungen bei normalen und schwachsinnigen Kindern. C. Bertelsmann, Gütersloh, 1904. pp. 62.

By careful empirical study the author finds a marked difference in the disposition of the normal and the weak-minded child. Upon his data he develops a theory of moods or changes of disposition which he holds capable of being unfolded into a system of remedial pedagogy. Caprice and a capricious will are one of the most characteristic signs of mental and moral defect.

The Annals of Psychical Science. January, 1905. First year, No. 1. London, W. C., pp. 65.

This new journal is addressed to those whose experience has brought them face to face with the mystic phenomena of psychic life. The directors of this enterprise are Dr. Dariex and Charles Richet, with whom are associated Professor Crookes, Flammarion, Lombroso, Morselli, Ochorowicz, and Schrenck-Notzing. This number is essentially devoted to a long article by the President-elect of the Society for Psychical Research, Professor Richet, on the subject, "Should the Phe-

nomena of Spiritism be seriously studied?" He concludes that there is no contradiction between spiritism and science, that the evidence for the latter is now so voluminous that it cannot be rejected without partial and serious preliminary study, that science is at present so elementary compared to what it will be that much more is possible than we now grant, and that the admitted absurdities of spiritism are not of a nature to prevent *a priori* our studying the experimental facts. He holds that there are some mediums who have never cheated. The seventeen pages of notes are confined to a few publications strictly in the line of the journal, and the content of the next number is to be Stainton-Moses, and two cases, one of lucidity and one of clairvoyance.

Unconscious Therapeutics; or, The Personality of the Physician, by ALFRED T. SCHOFIELD. P. Blakiston's Sons & Co., Phila., 1904. pp. 317.

A Manual on Mental Abnormalities, by J. T. SEARCY. Alabama Medical Journal, Sept., 1904. Tuscaloosa, Ala., pp. 22.

A System of Metaphysics, by GEORGE STUART FULLERTON. The Macmillan Co., New York, 1904. pp. 627.

All philosophic thinkers will welcome this systematic presentation of the author's views. Many special chapters of this work have appeared in various journals. Now we have what might be fairly called the author's philosophical system developed with great detail in four parts devoted respectively to the content of consciousness, the external world, mind and matter, other minds, and the realm of minds. Of the author's great ability and of the thoroughness of his long period of apprenticeship to the questions he here treats there can be no doubt, although he quotes very little and refers to literature very rarely. Without having read the work entire, but having glanced at a number of special chapters and sections, the chief criticism of the writer of this review would be prolixity. Could the author's theories have been put in a fraction, and a rather small one, of the 627 large pages of this book, we believe they would have gained very greatly in force of presentation and also have been made thus accessible to many minds who cannot possibly find the time to glean meanings diffused over so much space. This criticism is written from the standpoint of one disposed to sympathize in general with such of the author's positions as he has understood.

Abhandlungen der Fries' schen Schule. Herausgegeben von Gerhard Hessenberg, Karl Kaiser & Leonard Nelson. Vandenhoeck & Ruprecht, Göttingen, 1904. pp. 190. Pr. M. 4.-

This first volume contains three articles, one entitled The Critical Method and the Relation of Psychology to Philosophy, by Nelson. The second is upon the Idea and Problem of Natural Philosophy, and the third on the Idea of the Infinite in Mathematics.

La Science et l'Hypothèse, par H. POINCARÉ. Ernest Flammarion, Paris. pp. 284.

Mankind in the Making, by H. G. WELLS. Chapman & Hall, London, 1904. 2nd ed. pp. 429.

Human Nature and Morals according to August Comte, by JOHN K. INGRAM. Adam & Charles Black, London, 1901. pp. 115.

La Philosophie Naturelle Intégrale et les Rudiments des Sciences Exactes, par A. RIST. Première Partie. A. Hermann, Paris, 1904. pp. 131.

The chief topics here discussed are prolegomena of geometries and of

numerical analysis, numerical calculus as the proper domain of arithmetic, addition and substraction, numbers and their valuations.

The Taste-Names of Primitive Peoples, by CHARLES S. MYERS. The British Journal of Psychology, Vol. I, Part 2, June, 1904. University Press, Cambridge. pp. 117-126.

Archiv für Rassen- und Gesellschafts-Biologie einschliesslich Rassen- und Gesellschafts-Hygiene. Herausgegeben von Alfred Ploetz in Verbindung mit Hermann Friedmann, A. Nordenholz, und Ludwig Plate. 1. Jahrgang. 2. Heft. März, 1904. Berlin. pp. 161-320.

Pictorial Composition and the Critical Judgment of Pictures, by H. R. POORE, A. N. A. Second edition, revised. New York: The Baker and Taylor Co. pp. 282.

Mr. Poore's work is divided into three sections. The first (about two-thirds of the book) treats of the mechanics of pictorial composition: questions of arrangement of items within the picture space so as to guide the eye of the beholder in the way it should go, of balance of parts, of the management of light and shade, and other similar matters. The second treats briefly of the æsthetics of composition, dealing in part with the operation of principles already touched upon, but now in more far reaching relations, and in part with new ones: Suggestiveness, Mystery, Reserve, Finish. The third takes up, under the caption of "The Critical Judgment of Pictures," still other more general matters influencing the successful production and enjoyment of pictures. The discussions of the work are made concrete by eighty or more half-tone plates. An appendix, summing up the chief points of the work, and an index bring the volume to a close.

Psychologists who are interested in æsthetics will find in Mr. Poore's work a very valuable collection of facts and observations gathered by an artist of experience and generally ripened for psychological discussion. Certain pages in the first section especially might be transferred almost bodily to an account of the natural habits of visual attention, a matter upon which yet further light would be acceptable.

Principles of Architectural Composition; An attempt to Order and Phrase Ideas which have hitherto been only felt by the Instinctive Taste of Designers, by JOHN BEVERLY ROBINSON, with an Introduction by Russell Sturgis. New York: The Architectural Record Co., 1899, pp. x+135, fully illustrated.

This study does for architectural forms and groupings very much the same thing that Poore's work does for pictorial composition. It may be commended in the same way and for the same reasons to all who are interested in the psychology of the perception of beauty in visible form. The exposition is especially clear and to the point.